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APOLLO 16 PIP MOD D PROGRAM (R&D) [U]

Contract No. NAS 9-455

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Third Quarterly Technical Report

March 31, 1963

[redacted]

Prepared by

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I. INTRODUCTION

This report summarizes Sperry activities and technical progress under Contract No. NAS-9-455 during the period from December 3, 1962 through March 31, 1963. Ref. Apollo PIP TD Meeting March 22, 1963.

Bi-weekly Progress Reports on Apollo PIP Milestones and a monthly Industrial Line of Balance chart are being submitted in accordance with contractual requirements.

II. CURRENT STATUS OF THE PROGRAM

A. Block "O"

The current status of Block "O" is as follows:

1. Delivered Units:

S/N AP-1 on 10/16/62

S/N AP-2 on 10/16/62

S/N AP-3 on 11/29/62

S/N AP-4 on 12/31/62

S/N AP-5 on 12/31/62

S/N AP-6 on 2/7/63

S/N AP-7) converted and rebuilt as Block I units S/N IAP-9
) and IAP-10 per Contracting Officer's memos and
S/N AP-8) MIT/IL TWX of Feb. 1963

B. Block I

The current status of Block I is as follows:

1. Delivered Units:

S/N IAP-9	March 3, 1963
S/N IAP-10	March 6, 1963
S/N IAP-11	March 15, 1963

2. Undelivered Units:

S/N IAP-12	Ducosyn Ass'y
S/N IAP-13	" "
S/N IAP-14	" "
S/N IAP-15	" "
S/N IAP-16	" "

NOTE: Nine units in the process of finish grinding after potting.

3. Anticipated Delivery Schedule:

April	4 units
May	5 "
June	4 "
July	3 "

4. Parts Availability:

Recoverage is taking place because of high failure rates in potting and grinding of SG Microsyn Ass'ys and IS Microsyn Ass'ys. See Problem Areas. All other parts for Block I on hand and available for manufacturing.

C. Block II

1. Anticipated Delivery Schedule:

August 1963 through April 1964 5 units per month

2. Drawing and Parts Availability:

All basic drawings pertaining to Block II have been received from MIT/IL. Some new drawings of added parts involved in Apollo Change Orders have not yet been received. All of the purchased parts, with the exception of those items involved in change, have been placed on order. The promises of delivery from our various subcontractors and vendors are compatible with the revised Block II manufacturing schedule.

III. GENERAL ACTIVITIES

The significant activities and events pertinent to this program which occurred during this third quarter of the program are recorded below in chronological order:

Dec. 5, 1962 — Revised schedule for Block 0 after ACP #3049 corrected rotor problem

Dec. 5 — Received telephone notification from MIT/IL that tooling drawings P/N MA 96011 and MA 96191 will replace undelivered MA 96207-5, -7 and -37. Also P/N MA 96009 will replace the undelivered MA 96730-32.

Dec. 12 — N. Blumenstock hand carried from MIT/IL some seven (7) items necessary for production, two of which had to be reviewed by Sperry and adapted into the manufacturing process.

Qty.	P/N	Item
6	96149	Heater and Sensor
14	96190	Element Retainer
2	95907	Shroud, Magnetic
2	96121	Cover, Magnetic
7	(TBA)	Cable Retainer
1	(TBA)	Element Retainer Fixture
1	(TBA)	Cable Installation Fixture

Dec. 14 — J. Morgan attended an Apollo "Change Control Board" meeting at MIT/IL - proposed ACO's were reviewed.

Dec. 27 — Received seven ACO's from MIT/IL

Dec. 31 — Units AP-4 and AP-5 were delivered to MIT/IL

Jan. 3, 1963 — Received missing Tooling Drawing numbers from MIT/IL:

P/N	Description
MA96009	Float Support Assembly
MA96011	Assembly Tube
MA96191	Bracket Assembly

Jan. 3 — J. Morgan and C. Willette conducted a surveillance trip to Danco Tool and Mold Co., Phoenixville, Pa. to review stator core problems (see Problem Areas).

Jan. 8 — Technical Meeting with MIT/IL and NASA held at Sperry covering Test Specs and Block Schedules

Jan. 8-11 — Thirty-seven (37) revised Apollo PIP drawings for Blocks "0" and "I" were received from MIT/IL. Thirty-two (32) were released without problem. The remaining five involve various problems discussed under Problem Areas.

Jan. 14 — Seventy-seven (77) Apollo PIP Block II drawings plus a Document Control List, PIP Parts List and Accessories Parts List were received from MIT/IL.

Jan. 18 — Open Loop Test for Block 0 defined by telecon between J. Cooney of Sperry and R. Massaro of MIT/IL. Subjects concerned: MC1500 draft copy of Open Loop Test, drawings, test mount and test console.

Jan. 21 — Block II drawings released to manufacturing

Jan. 24 — Received MC1500 draft copy of Open Loop Test for Apollo PIP and a preliminary version of the final test mount

Jan. 25 — M. R. Hannah of Sperry investigated Block I grinding problems at American Beryllium in Sarasota, Fla. Refer to Problem Areas, Section V, of this report.

Jan. 28 — Unit designated as AP-7 completed the first open loop final test.

Jan. 29 — Re-start of 15 coils through assembly utilizing the Sperry-manufactured fixture for radial and axial positioning of end turns prior to impregnation and potting to prevent grinding breakthrough

Feb. 1 — Change Control Board and TD Meeting at MIT/IL at which meeting Sperry agreed to enact the following due to a design change in the Rotor Ass'y and Float Body:

A. Modify the quantity of 16 PIP Mod D units to be delivered under Contract NAS 9-455 as follows:

1) Reduce total quantity from 72 to 70 by eliminating 2 of the 8 units (P/N 95944) constituting the Block 0 deliveries.

2) Serial numbered units AP-7 and AP-8 already built as Block 0 units (P/N 95944) to be re-built replacing the Microsyn Housing, Potted Torque Generator P/N 95951 with Microsyn Housing Potted Torque Generator P/N 96123

3) On serial numbered unit AP-7 and all subsequent units rotate the Rotor (P/N 96014 Rev. B) 45 degrees (either direction) with respect to the Float Body P/N 95921 in the IA-PRA plane. Modify the procedures and tooling necessary to accomplish this (T.G. end only).

B. Eliminate the requirement for closed loop testing on serial numbered units AP-7 through AP-18 inclusive.

C. On Block II units (45 units total) modify the following parts as directed:

1) Rotor P/N 108008 - eliminate the .1875 inch wide axial slots. Place a hold on the fabrication of these parts at that operation in which the slots are made.

2) Float Body P/N 108002 - eliminate the .1875 inch wide axial slots. Place a hold on the fabrication of these parts at that operation in which the slots are made.

3) Damping Fluid P/N 108054 - change the density of the fluid (specification to follow).

4) Balancing Fluid (Appendix A-8 to MC-1500) - change density to conform to 3) above (specification to follow).

5) Density Plummets P/N MA-96670-12-1 and MA-96670-12-2 - change density and color (specification to follow).

6) Ring Alignment P/N 108047 - place a hold on the fabrication of these parts pending a change in material and geometry.

7) Ring, Mounting P/N 108047 - place a hold on the fabrication of these parts pending a change in material and geometry.

Feb. 7 — Unit AP-6 delivered to MIT/IL. Units AP-7 and AP-8 started tear-down to prepare for design changes

Feb. 8 — Pending receipt of MIT/IL Apollo Change Orders defining new configurations, the following Block II parts are now on "HOLD" status:

P/N 108002	Float Body
108008	Rotor
108047	Alignment Ring
108048	Mounting Ring
108054	Damping Fluid
(-)	Balancing Fluid

Feb. 8 — Sperry Engineer J. Morgan reviewed quality control difficulties and measurement techniques at American Beryllium.

Feb. 13	T. Williams and R. Murray of American Beryllium visited Sperry to resolve recent quality control problems. Among the changes agreed upon were a polishing operation on alignment and mounting rings to permit optical flat measurements; a deburring operation on Float Bodies prior to reaming to permit safe withdrawal of tool; and main housing squareness requirements to be changed by MIT/IL.
Feb. 19	Sperry received 3 work copies of the MC-1500 Ass'y and Test Manual from MIT/IL and started immediate review by Engineering, Q.A., Methods and Manufacturing.
Feb. 25	Sperry has placed a "hold" on purchased parts releases as of 2/1/63 awaiting change information from MIT/IL. The lack of said information will cause schedule slippage and increased cost. A MIT/IL TWX was received 2/21/63 releasing changes on the affected area. Sperry prepared emergency change orders and a Quotation Estimate to evaluate the cost and schedule impact of the said changes.
Mar. 1	Apollo Change Control Board Meeting at MIT/IL attended by J. Morgan and C. Willette.
Mar. 3	Unit IAP-9 delivered to MIT/IL
Mar. 6	Unit IAP-10 delivered to MIT/IL
Mar. 6	J. Morgan visited MIT/IL for a CCB meeting where 45 ACO's were approved and presented to Sperry These changes affected Blocks I and II.
Mar. 11	ACO #3097 was received from MIT/IL for preparation of a budgetary estimate. This change adds a Suspension Capacitor Ass'y to Apollo PIP Block II units. The budgetary estimate required quotes from a vendor in California plus other inputs; was completed; and a TWX sent to M. Holzman of NASA advising the budgetary estimate of cost and the conditions on which it was based for installation in Block II. Sperry will await NASA authorization for the expenditure of existing Apollo PIP funds to accomplish ACO #3097 in advance of a formal contract change.
Mar. 12	The Sperry Apollo PIP Change Committee reviewed all of the 45 ACO's. Twenty-six were released immediately as "no cost increase" changes. The remaining ACO's were held temporarily for budgetary estimates of cost. Half of these involve subcontractors who must be contacted to determine whether costs have been affected. A listing of the ACO's appears under Sec. IV. of this report. The remaining 19 ACO's were released Mar. 19, 1963.

Mar. 15 — Unit IAP-11 delivered to MIT/IL

Mar. 16 & 17 — N. Martin of MIT/IL visited Sperry for the purpose of reviewing Sperry's comments on and recommendations for the proof copy of the proposed MC-1500 Assembly and Test Manual.

Mar. 22 — N. Blumenstock, R. Hannah, J. Morgan of Sperry attended an Apollo PIP TD meeting at MIT/IL. The purpose of the meeting was to review status of all changes to date.

Mar. 25 — Twenty P/N IAP 96014 Rotors were received from MIT/IL to cover Block I scrappage. One of these arrived in a chipped condition.

Mar. 25 — TWX #TT623541 authorizing go-ahead on ACO's 3097 and 3115 was received on 3/25/63 from the NASA Contracting Officer, M. Holzman. These ACO's are the Suspension Capacitor Module installation and the Sperry designed Rotor Alignment Fixture. Both jobs were released for manufacture.

Mar. 27 — TWX #TT623570 dated 3/27/63 from E. Fairweather of MIT/IL covered the following points:

1) Authorized use of single polythermaleze wire in place of heavy polythermaleze wire as soon as possible in all Model D PIP units SG and TG Microsyns. Change orders were to follow. (This is already under way.)

2) Ferrite rotor material was changed from MN-31 to MN-31-M. (This affects only future orders since Mod D PIP rotors have already been procured.)

3) Authorized use of glass tubing in place of TYGON tubing for introduction of damping fluid into the Fill Tank. (Sperry is investigating this change and will submit estimate of cost as soon as possible.)

IV. STATUS OF ACO'S ISSUED BY MIT/IL

The status of all Apollo Change Orders (ACO's) issued by MIT/IL during this program to date is as follows:

ACO No.	Date Rec'd	Cost Incr.	Sched. Delay	Auth. Req'd	Auth. Rec'd	Current Status
965	8/13/62	No	No	No	10/11/62	Released
966	8/13/62	"	"	"	"	" 8/17/62
968	8/14/62	"	"	"	"	" 8/16/62
969	8/13/62	"	"	"	"	" 8/17/62
970	8/13/62	"	"	"	"	" "
971	8/13/62	"	"	"	"	" "
973	8/13/62	"	"	"	"	" "
1001	7/30/62	"	"	"	"	" 8/15/62
1002	7/30/62	"	"	"	"	" "
1003	7/30/62	"	"	"	"	" "
1004A	8/27/62	"	"	"	"	" 8/28/62
1005A	8/27/62	"	"	"	"	" "
3001	8/8/62	"	"	"	"	" 8/15/62
3002	8/8/62	Yes	Yes	8/15/62	"	" "
3003	8/8/62	No	No	No	"	" "
3004	8/8/62	"	"	"	"	" "
3005	8/8/62	"	"	"	"	" "
3006	8/8/62	"	"	"	"	" "
3007	8/8/62	Yes	Yes	9/8/62	"	" 9/11/62
3008	8/8/62	"	"	"	"	" "
3009	10/3/62	"	"	9/17/62	"	" 10/12/62
3010	8/8/62	No	No	No	"	" 8/15/62
3011	8/8/62	"	"	"	"	" "
3014	8/8/62	"	"	"	"	" "
3015	8/8/62	"	"	"	"	" "
3016	8/27/62	"	"	"	"	" "
3017	8/27/62	"	"	"	"	" 8/28/62
3018	8/27/62	Yes	Yes	8/29/62	"	" 8/29/62
3019	8/27/62	"	"	8/28/62	"	" 8/28/62
3021	8/27/62	No	No	No	"	" "
3022	8/27/62	"	"	"	"	" "
3023	12/18/62	"	"	"	12/18/62	" 12/19/62
3024	10/5/62	"	"	"	10/11/62	" 10/11/62
3025	9/14/62	Yes	Yes	8/15/62	10/11/62	" 10/12/62
3026	10/5/62	Decr.	No	10/22/62	—	" 10/22/62
3027	11/23/62	No	No	No	—	" 11/26/62
3028	11/23/62	"	"	"	—	" 11/26/62
3029	12/18/62	"	"	"	—	" 12/19/62
3030	11/23/62	Yes	"	Yes	—	" Bk.II 11/26
3033	11/23/62	No	"	No	—	" 11/26/62
3034	11/23/62	"	"	"	—	" "
3035	11/23/62	"	"	"	—	" "
3036	11/23/62	"	"	"	—	" "
3037	11/23/62	"	"	"	—	" "

ACO No.	Date Rec'd	Cost Incr.	Sched. Delay	Auth. Req'd	Auth. Rec'd	Current Status
3038	11/23/62	No	No	No	-	Released 11/26/62
3039	11/23/62	"	"	"	-	" "
3040	11/23/62	"	"	"	-	" "
3041	11/23/62	"	"	"	-	" "
3042	11/23/62	"	"	"	-	" "
3044	12/18/62	"	"	"	-	" 12/19/62
3045	11/23/62	"	"	"	-	" 11/26/62
3046	11/23/62	"	"	"	-	" "
3047	11/23/62	"	"	"	-	" "
3048	11/23/62	"	"	"	-	" "
3049	11/23/62	"	Yes	Yes	-	" "in adv of auth
3050	11/23/62	"	No	No	-	" 11/26/62
3051	11/23/62	"	"	"	-	" "
3052	11/23/62	"	"	"	-	" "
3054	12/18/62	"	"	"	-	" 12/19/62
3056	12/18/62	"	"	"	-	" "
3061	12/18/62	"	"	"	-	" "
3063	12/27/62	Yes		Yes	No	" in adv of auth
3064	12/18/62	No	"	No	-	" 12/19/62
3065	"	Yes	"	Yes	No	" in adv of auth
3068	"	No	"	No	-	" 12/19/62
3069						Cancelled
3071	1/18/63	Yes		Yes	No	Released 1/21/63 in adv of auth
3072	3/8/63	No		No	-	" 3/12/63
3073	"	Yes		Yes	No	" " "
3074	"	"		"	"	" 3/14/63 "
3075	"	"		"	"	" 3/12/63 "
3076	"	TBA		TBA	-	" " "
3077	"	No*		No	-	" "
3078	"	Yes		Yes	No	" " "
3079	"	"		"	"	" " "
3080	"	No*		No	-	" "
3081	"	TBA		TBA	-	" 3/15/63
3082	"	No		No	-	" 3/12/63
3083	"	TBA		TBA	-	" 3/15/63
3084	"	TBA		TBA	-	" "
3085	"	TBA		TBA	-	" "
3086	"	No		No	-	" 3/12/62
3087	"	"		"	-	" "
3088	"	"		"	-	" "
3089	"	"		"	-	" "
3090	"	"		"	-	" "
3091	"	"		"	-	" "
3092	"	"		"	-	" 3/15/63
3093	"	Yes		Yes	No	" 3/22/62 "
3094	"	TBA		TBA	-	" 3/15/63
3095	"	TBA		TBA	-	" "
3096	"	Yes		Yes	No	" " "

ACO No.	Date Rec'd	Cost Incr.	Sched. Delay	Auth. Req'd	Auth. Rec'd	Current Status
3097	3/8/63	Yes		Yes	No	Released 3/15/63 in adv of auth
3098	"	"		"	"	" " "
3099	"	"		"	"	" 3/22/63 "
3100	"	"		"	"	" 3/12/63 "
3101	"	"		"	"	" " "
3102	"	"		"	"	" " "
3103	"	"		"	"	" " "
3104	"	"		"	"	" " "
3105	"	"		"	"	" " "
3108	"	No		No	-	" "
3109	"	"		"	-	" "
3111	"	Yes		Yes	No	" 3/14/63 "
3112	"	Decr.		"	"	" in Feb per TWX
3113	"	No		No	-	" 3/12/63
3114	"	"		"	-	" "
3115	"	Yes		Yes	No	" 3/15/63 in adv of auth
3116	"	"		"	"	" " "
3117	"	"		"	"	" " "
3118	"	"		"	"	" " "
3119	"	No**		No	-	" 3/12/63
3120	"	No**		"	-	" "

* No cost if MIT/IL supplies Density Floats by 4/1/63
** No cost if parts supplied by MIT/IL for Block I

V. PROBLEMS ENCOUNTERED

A. Shroud Size Difficulty

Unit AP-10 Magnetic Shroud P/N 95907 appeared to be too tight a fit over Spacer P/N 95926. Another slightly larger shroud was selected to complete the assembly. Sperry recommended that MIT/IL consider loosening the line-to-line fit of the shroud to the spacer by .002" in order to ease the tight fit. Engineering Change Request submitted. Heat curing of the cement holding the 95926 Spacer caused some shifting of the spacer and swelling of cement. A Sperry fixture was designed and used to prevent this from aggravating the shroud tight fit problem.

B. Drawing Problems

1. Late delivery of new drawings (such as P/N's 96303 and 96302) as well as late receipt of drawings revised due to ACO's from MIT/IL (example, P/N 96141, 96059, 95925) affect the cost and delivery schedules of the various blocks. Sperry's configuration control system and production control procedures require simultaneous release of all ACO affected drawings to properly execute and control a design change.

2. Tool drawings (Van Dykes) of the Float Support Assembly P/N MA96009, Assembly Tube P/N MA96011, and Bracket Assembly P/N MA 96191 were received from MIT/IL. All three are apparently superseded prints unchanged from the original issue. A problem still existed, therefore, due to the following:

1) In November an unofficial copy of the new filling tank fixture print #MA96207-1 was given to Sperry during a visit to MIT/IL. This print called out new P/N's for the Float Clamp Assembly MA96730-32, the Assembly Tube MA96207-7, and the Bracket Assembly MA96207-5. The official copies of these prints were to be released later.

2) The filling fixture has been modified in accordance with MA96730-1 (unofficial) but detail changes are unknown at this point.

3) Sperry listed P/N's MA96009, MA96011, and MA96191 erroneously as missing. What was needed, of course, were the new or updated versions.

4) Receipt of drawing P/N MA96141-1A cleared up problems associated with this fixture.

3. ACO #3046 received 11/23/62 and ACO #3062 received 12/27/62 were assigned the same revision sub-letter. This situation is not compatible with Sperry's standard system of configuration control during manufacture, or with that of Sperry's subcontractors, and must be avoided. Simultaneous release of two changes can be included under the same sub-letter but sequential release of such changes destroys control of configuration.

4. It is recommended that MIT/IL include copies of internal ECO's when they are listed on a print as revising it. Sperry placed a "hold" on P/N MA96670B due to the lack of MIT/IL ECO #1278. Problem alleviated when ECO was received.

C. Heater Sensor Element Fixture Difficulty

The heater sensor element retaining fixture (P/N "TBA") supplied by MIT/IL the week of 12/14/62 was placed in service. The first unit assembled by this method unfortunately had the heater sensor element wires pinched during the operation. Rework of the fixture eliminated the problem but the heater sensor element for unit AP-4 had to be scrapped.

D. Gassing Problem

1. Unit AP-6 was found to be gassing during pressure cycling from 20 millimeters to 5 millimeters.

2. A complete detailed investigation was not possible due to delivery schedule commitments; however, Unit AP-6 was disassembled, subjected to a thorough cleaning, and recycled through assembly. This apparently relieved the trouble and the unit passed test.

E. Danco Stacks Oversize and Permeability Problem

Recently received lamination stacks from Danco Tool Co. appeared to be oversize and to have low permeability. This was checked out at Danco by J. Morgan and C. Willette as follows:

1. Poor registration of the lams in the stacks was caused by an improper set-up of the dies. This was a random operation and resulted in the O.D. being out of concentricity with the I.D. Since the stacks were piloted on the I.D., the O.D. of various lams appeared to have shifted and the stack O.D. appeared too large. This problem was immediately rectified and the nine affected stacks from Sperry were reworked by Danco.

2. The permeability problem developed as follows:

- MIT/IL specifies "Hypernik" on manufacturing drawings for lam stacks. Permeability is not specified but heat treat is. Westinghouse is listed as the supplier.

- Sperry purchases "Hypernik" type material in accordance with Sperry Standard MFA which includes a comprehensive purchase specification that defines required flux density, chemical composition, permeability, etc. Sperry experience indicates that Carpenter Steel #49 (4750 alloy) is an excellent source of "Hypernik" type material.

- Danco had standardized on Carpenter Steel #49 material since it is thoroughly checked and certified by Carpenter prior to delivery as to permeability, etc. Danco inspection of received material has verified this.

- Apollo PIP lamination material was received from Westinghouse by Danco and found to have permeability approximately 50% lower than the Carpenter Steel #49 alloy. Since the MIT/IL prints did not specify permeability, Danco used the Hypernik as is.

- MIT/IL (Mr. Lou Eichenger) found that these microsyn cores had permeability four times lower than normal and advised Sperry.

- Sperry visited Danco to investigate. Westinghouse was contacted (Mr. Don Del Frate) and admitted that their certification was a mimeograph form which stated the chemical properties of their Hypernik and the maximum permeability in the hard condition. The space for permeability after annealing was not filled in. Westinghouse agreed to fill in this information on future batches and that the permeability should have been higher. They recommended a long (10 hour) additional heat treat which appears to be of doubtful value.

- Mr. Lou Eichenger of MIT/IL was contacted and agreed to issue more stringent specifications, such as Sperry MFA. He recommended that Sperry use existing microsyns as is and suggested that the Hypernik may be prone to permeability changes due to handling after heat treat. He did not believe that this low permeability would be an important factor.

- Danco will now use Carpenter #49 for Sperry Apollo PIP's.

. Sperry obtained ring samples of Westinghouse Hypernik both before and after heat treat, Carpenter Steel #49, and Alleghany Ludlum #4750 for metallurgical tests and chemical analyses. Possible reductions in permeability due to handling will also be investigated.

3. Further investigation of the Alfenol I.S. lamination problem including a telecon (J. Morgan to L. Eichinger of MIT/IL) resulted in the decision to scrap out the contaminated laminations. The problem was then turned over to Sperry's Quality Assurance Dept. to insure that these instructions are carried out at Danco. Replacement of the Alfenol material at this time will affect Danco's schedule delivery of I.S. stator cores by at least 2 weeks. This may also have an effect on Sperry's scheduling for the I.S. assembly.

F. Grinding Problems at American Beryllium

A serious problem has been encountered during grinding operations at American Beryllium. This problem developed as follows:

1. Eight potted I.S. Assemblies P/N IAP95912 were shipped to American Beryllium on January 18 for finish grinding.

2. Of the first seven units ground by January 24, five showed evidence of cutting into the end turns on the short side of the taper. Two were satisfactory.

3. With R. Hannah of Sperry observing, it was determined by dimensional checking with MIT/IL prints that the I.S. Assemblies (P/N IAP93236) were properly bottomed on the I.S. Support (P/N IAP95956).

4. An immediate "HOLD" was placed on the remaining 13 I.S. Assemblies (P/N IAP93236) not yet potted but already impregnated.

5. Examination of the 13 units ready for potting revealed they are apparently to print and very tightly machine wound.

6. The P/N 95961-1 taper gauges supplied to Sperry and American Beryllium by MIT/IL were suspected but Sperry does not have the MIT/IL taper gauge drawing.

7. There is no existing specification as to radial position of the end turns of the P/N IAP93236 Assembly.

8. J. Morgan of Sperry telephoned G. Fairweather of MIT/IL re this problem on January 25. The location of the taper relative to the end turns was obtained in order to determine the clearances involved.

9. Block "O" potted I.S. Assemblies were ground without this interference and the only apparent difference in design is the removal of a 45° chamfer on the winding slot bores of P/N IAP93239.

10. Ten more I.S. Assemblies P/N IAP93236 are now available prior to impregnation.

11. The action planned to eliminate the problem is as follows:

- The required clearance from taper to coils will be calculated.
- An attempt will be made to adjust the ten I.S. Assemblies to provide this clearance.
- The 13 impregnated I.S. Assemblies will be checked to determine if any will provide the necessary clearance.
- All acceptable I.S. Assemblies will then be potted and sent to grinding.
- An Engineering Change Request will be submitted to MIT/IL requesting the required definition of end turn radial position on the P/N IAP93236 I.S. Assembly drawing.
- Sperry will X-ray and/or section the damaged I.S. Assemblies to determine the degree of eccentricity built into these units. This could be a possible source of trouble if the bore of the I.S. Assembly P/N IAP93236 is excessively eccentric relative to the winding slot bores. A check of tolerances involved indicated a design maximum eccentricity of .006", which should not cause trouble.

12. The full impact of this problem on the scheduled delivery of unit AP-10 and subsequent has yet to be determined.

13. Cross sections and X-ray photographs of the five damaged P/N IAP95912 Assemblies revealed that the interference was due solely to the placement of the end turns on the I.S. coils.

14. The 13 impregnated I.S. Assemblies have been checked against the end turn wire placement tool and the necessary clearance was lacking. These assemblies cannot be used for the Apollo PIP but will be acceptable to the Polaris PIP program.

15. The remaining unimpregnated I.S. Assemblies have had their end turns repositioned and are currently in process of impregnating and potting.

16. Eccentricity has not caused this problem. The cross-section and X-rays verified this conclusion.

17. Sperry is now awaiting and ACO defining the desired configuration of I.S. coil end turns.

18. ACO #3093 and ACO #3099 were received on 3/8/63 affecting Blocks I and II.

G. Apollo Test Requirements Waiver

1. At the CCB meeting of December 14, J. Miller of MIT/IL advised that CFE Apollo PIP Final Test Console would not be available until Feb. 1, 1963. Sperry requested a waiver of test requirements on all units available before test equipment is operative.

2. The console could be used in January for open loop testing so that the waiver would apply to dynamic test only.

3. Contracting Officer's memos were received, thereby formalizing the waiver of dynamic test until the console is fully operative and the Final Test Procedure is defined.

4. It is anticipated that the waiver on dynamic test will be lifted starting with unit IAP-19.

H. PIP Filling Technique

Sperry investigation of the one-bottle filling technique indicated that the volume of one bottle of damping fluid is insufficient to fill the fluid reservoir and associated plumbing as required to permit a pressure-fill. This pressure filling will be mandatory for Block I; therefore redesign of this filling fixture will be necessary.

A Sperry change request #A-35 has been sent to MIT/IL suggesting a redesign of the filling fixture.

I. Possible Problem Areas Reported by Sperry

The following items were reported as possible problem areas to be reviewed by MIT/IL for necessary action:

1. Tolerance build-up on the P/N 95913 Float Assembly permits a possible .025" interference between the P/N 96014 Rotor and the Float End Plate P/N 93211. Although this has not occurred to date, it is possible and could cause scrappage when it does occur.

2. The P/N 95913 Float Assembly for unit AP-2 did not require any adjustment for pendulosity. This would seem to indicate the present design is on the borderline of pendulosity adjustment capability.

3. The P/N 95913 Float Assembly for unit AP-5 did not require the installation of any flotation screws P/N 93213 to achieve neutral buoyancy. This would seem to indicate that the present design is on the borderline of neutral buoyancy adjustment with the flotation screws that are available.

4. Tolerance build-up between the threads of the Stop Screw P/N 96005, the Pendulous Weight P/N 96006, and the Float Body Bore permits inclination of the stop screw from the perpendicular to the IA and OA axes. This has resulted so far in maximum inclinations of 2° 29' in the PRA input axis plane and 2° 42' in the PRA output axis plane which occurred in unit AP-4. There is no existing specification on this perpendicularity; therefore it is suggested that dimensions be placed on the bottom of the stop screw defining the perpendicularity of its longitudinal axis and flatness plus a similar definition for the threaded bore of the float.

5. The present distribution of end stones available under P/N 93256 (-1 through -9) provides for adjustment in .0004" steps. The MC procedure in Addendum D-1 to MC-1000 requires adjustment to .0002". It is suggested that additional dash numbers be provided to accommodate this requirement.

J. Coil "Megger" Failures

Sperry contacted Mr. Lou Eichenger of MIT/IL relative to use of Mylar tape instead of Durafilm under the preset coil windings. The first couple of Block I T.G. Microsyns assembled with the reset coils wound on Durafilm coating suffered "megger" failures. Mr. Eichenger had agreed to the preparation of several units with Mylar tape. This arrangement looks good and should be incorporated as soon as possible. Sperry prepared a Change Request for this item. Experience has since proved the Mylar tape impractical for this purpose and a solution was achieved using the Durafilm.

K. Rotor Rotating Difficulties

No tolerances were given on the alignment and orientation of the S.G. and T.G. rotors after rotating 45 degrees as per TWX #TT623243. Sperry's Methods and Tooling Engineering group had stated they must have rotor alignment tolerances for the preparation of an alignment fixture. It should be noted here that alignment of other rotors was accomplished with the use of an MIT/IL supplied fixture and that the Manufacturing Drawings do not specify assembly tolerances. In addition, the slots were used to orient the rotors with a Sperry fixture; however, the slots have now been removed. These difficulties were alleviated by the receipt of ACO 3073 from MIT/IL on March 8, 1963 which furnished information required to accomplish this change.

L. Stator Core Contaminations

Danco Tool and Mold has advised that Alfenol laminations for Apollo Internal Suspension Stator Cores were received back from Eastern Heat Treat contaminated with a substance that prevents stacking of the cores. They have tried cleaning in accordance with existing specifications but with no improvement. All 2000 laminations for this current order are affected. If a suitable cleaning method (one that won't damage the oxide coating) cannot be found, then it will take approximately two weeks to replace these laminations, and deliveries of needed I.S. cores will be similarly affected. Danco will investigate further and advise progress.

M. Concentricity Problem

S/N IAP-11 exhibited a radial centering ratio that was 200% of spec requirements. This apparently resulted from the previously reported concentricity tolerance build-up problem. MIT/IL was previously contacted relative to an out of spec concentricity condition found in this unit. A waiver was obtained since the problem arose due to tolerance build-up.

MIT/IL took the concentricity problem under advisement and recommended that out of spec tolerance build-up cases be examined as they occur.

The radial centering ratio problem of unit S/N IAP-11 was referred to MIT/IL, R. Massaro, who gave Sperry a telecon waiver on this condition and instructed Sperry to proceed with final tests of the unit. A confirming TWX was requested.

It is recommended that MIT/IL review the jewel-pivot-rotor-float concentricity tolerance and related radial centering ratio problems to determine whether changes can be made to eliminate or minimize these problems.

N. Parts Shortage Problem

In order to expedite the incorporation of certain ACO's, MIT/IL has been contacted and has agreed to provide Sperry with the following parts:

Qty.	P/N	Description
20	96014	Rotor
10	96015	Connector Wire Retainer
18	96106	End Cover, Insulating
18	96102	Identification Label, NASA
3 sets	MA96670-12	Density Floats (Block II)

There is an urgent need for these parts.

O. Suspension Capacitor Assembly Difficulties

The requirement for final information on the Suspension Capacitor Assembly will be affected by the apparent 4-5 week schedule slippage resulting from grinding and other problems. Although the due dates for specific items such as the NASA specs #1002057, 1005400 and 1005404 could slip with the schedule, it would be helpful to have all required information earlier.

NOTE: All of the Suspension Capacitor Assembly prints received from MIT/IL contained the statement: "Not approved for Production". Since Sperry had to release the job with these prints, this statement was written out prior to release.

P. A Potential Problem Area

Due to the apparent concern on the part of the Apollo system people with possible variation in damping coefficients, Sperry has begun a critical evaluation of all procedures concerned with the damping fluid and the processing procedures used during degassing and filling operations.

An examination of the principle of operation of the specified Molecular Vacuum gage shows that the indicated pressure of this gage is proportional to the molecular weight of the fluid whose pressure is being measured. Since this gage is calibrated for dry air (molecular wt. $\approx$ 28) and is being used with hydrocarbon vapors (molecular wt. $\approx$ 1000), an appreciable error in pressure exists between absolute pressure and the indicated gage pressure. The literature furnished by the manufacturer indicates that the full scale value of pressure of this molecular gage when used with a fluid of molecular weight of 1000 is approximately 0.1 mm. The procedure presently calls for filling at 20 mm, which is the full scale value for this gage when used with dry air. A further problem could exist during degassing. If this gage is used uncalibrated for the damping fluid molecular weight, and the indicated pressure is used during degassing (specified as 50 microns*), an absolute air pressure considerably lower than this will actually be attained. If this is done, the higher vapor pressure fraction of the damping fluid will be "stripped out", resulting in a change in viscosity (in the instrument a change in damping coefficient) and density.

Sperry is presently investigating the magnitude of this possibility.

Sperry feels that a TD meeting to discuss this potential problem and to take steps deemed necessary to minimize its effects should be initiated in the near future.

* per Addendum D-1 to OD 23607

VI. CONCLUSION

As of March 31, 1963 the Apollo PIP R & D Program at Sperry is on schedule in accordance with the latest revised block delivery schedule determined at the Apollo PIP TD meeting of March 22, 1963 at MIT/IL. At this same meeting MIT/IL outlined the change from the Terniary Moding to the Binary Type of Moding which will result in the application of closed loop test to earlier units, possibly beginning with Serial No. IAP-12.

The three Block I delivered units were tested open loop. These units met agreed upon test spec requirements between MIT/IL and Sperry with the exception of two specs presently being investigated at MIT/IL (the Average Angular Spread and Radial Centering Ratio).

The block system continues to provide problems in the areas of purchasing of small quantities and limited supplies of reserve parts to cover yield rates. ACO #3112 decreased the total quantity of delivered units from 72 to 70, which eased the overall block coverage problem to some extent. However, new manufacturing problems, such as those encountered during the grinding of microsyn parts, severely affected parts coverage, yield rates and block schedules. ACO's have been issued by MIT/IL to correct these problems as they occurred.

VII. CURRENT LINE OF BALANCE CHART AND SUMMARY

The Line of Balance Chart dated 3-15-63 (Page 25) indicates deliveries from December 1962 through March 1963 in accordance with the latest "proposed" or revised schedule.

The horizontal "LOB" indicates the supplies of parts and availability of subassemblies required for Block I manufacture are currently adequate to meet the latest revised schedule.

Since Block II was released for manufacture during this reporting period, all parts are now on order and the first deliveries of items such as stator cores have been received. A Block II Line of Balance Chart will be prepared shortly and included in the next quarterly report.

16 PI

INDUSTRIAL PROGRAMMING LINE OF BALANCE CHART

SPERRY GYROSCOPE [illegible]
Division of Sperry Rand [illegible]

Chart No. [illegible]
Date [illegible]

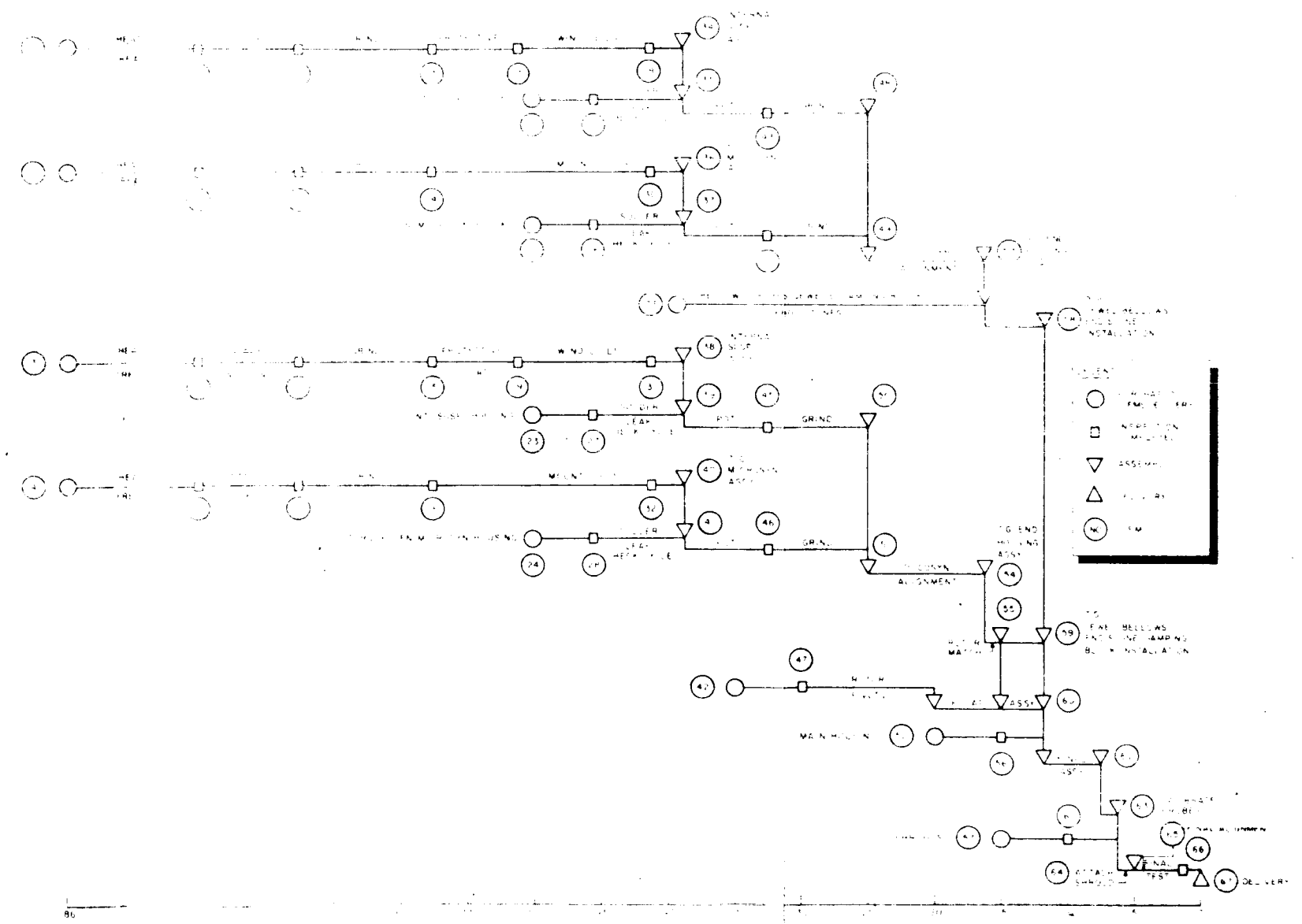
CUMULATIVE DELIVERY SCHEDULE
(UNIT TYPE)

BLOCK "0"

ACTUAL BLOCK "0" SCHEDULE

2 1 2 0 1 (2)

PRODUCTION PROGRESS
(CUMULATIVE END ITEM SETS)



WORKING PERIOD PRIOR TO SHIPMENT
22 WORKING DAYS PER MONTH

PRODUCTION PLAN
SCHEDULE FLOW OF MATERIALS, COMPONENTS AND PARTS

SUMMARY CHART

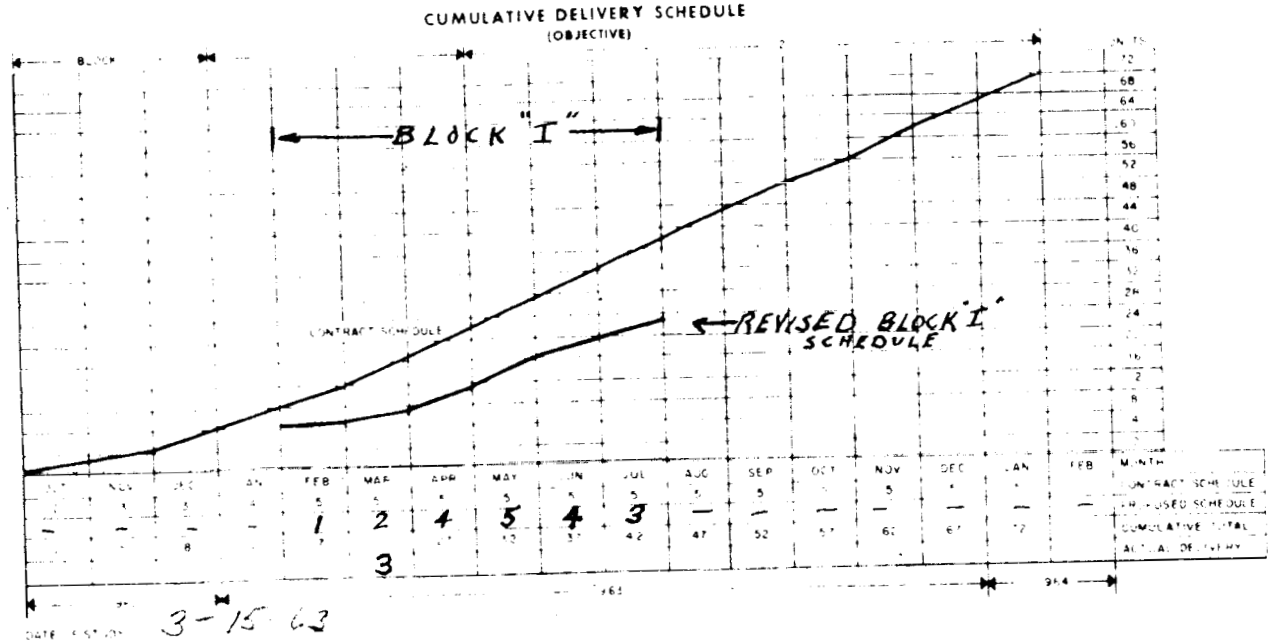
Contract No NAS-9-455
Units in Contract – 72
Contract Date – 1-1-63

16 PIP
INDUSTRIAL PROGRAMMING LINE OF BALANCE CHART

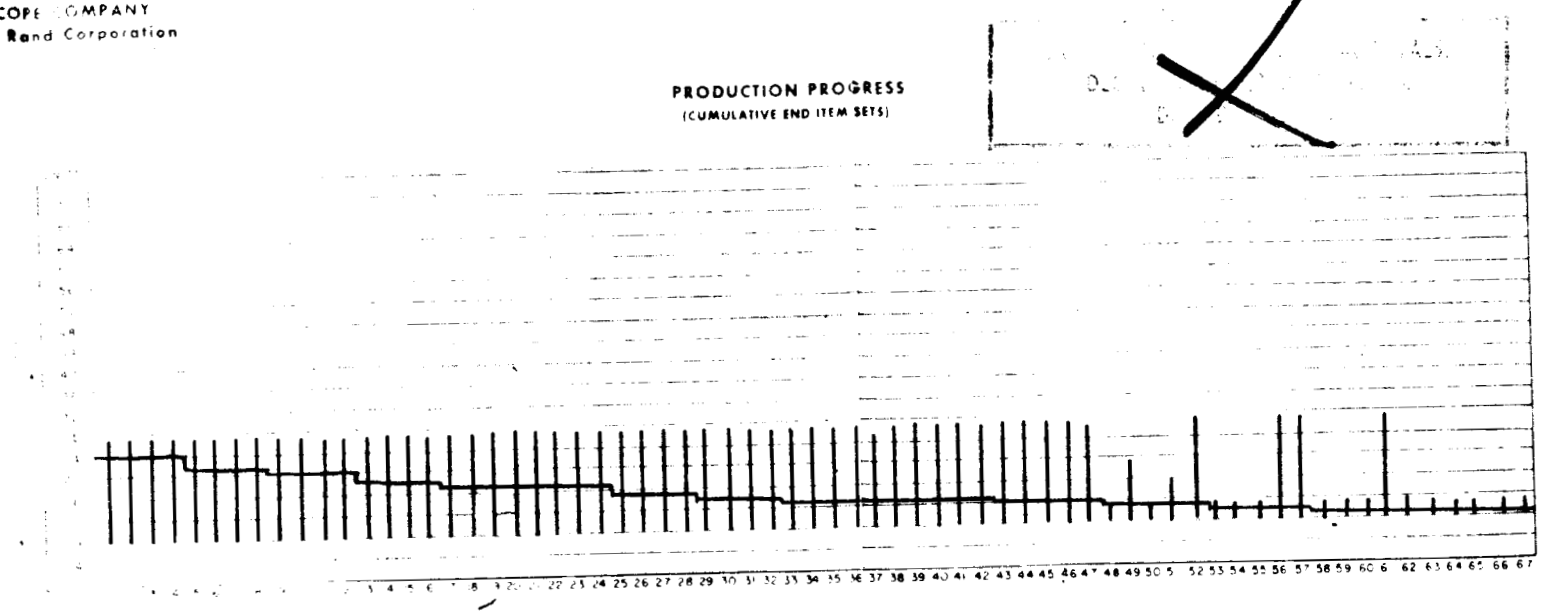
SPERRY GYROSCOPE COMPANY
Division of Sperry Rand Corporation

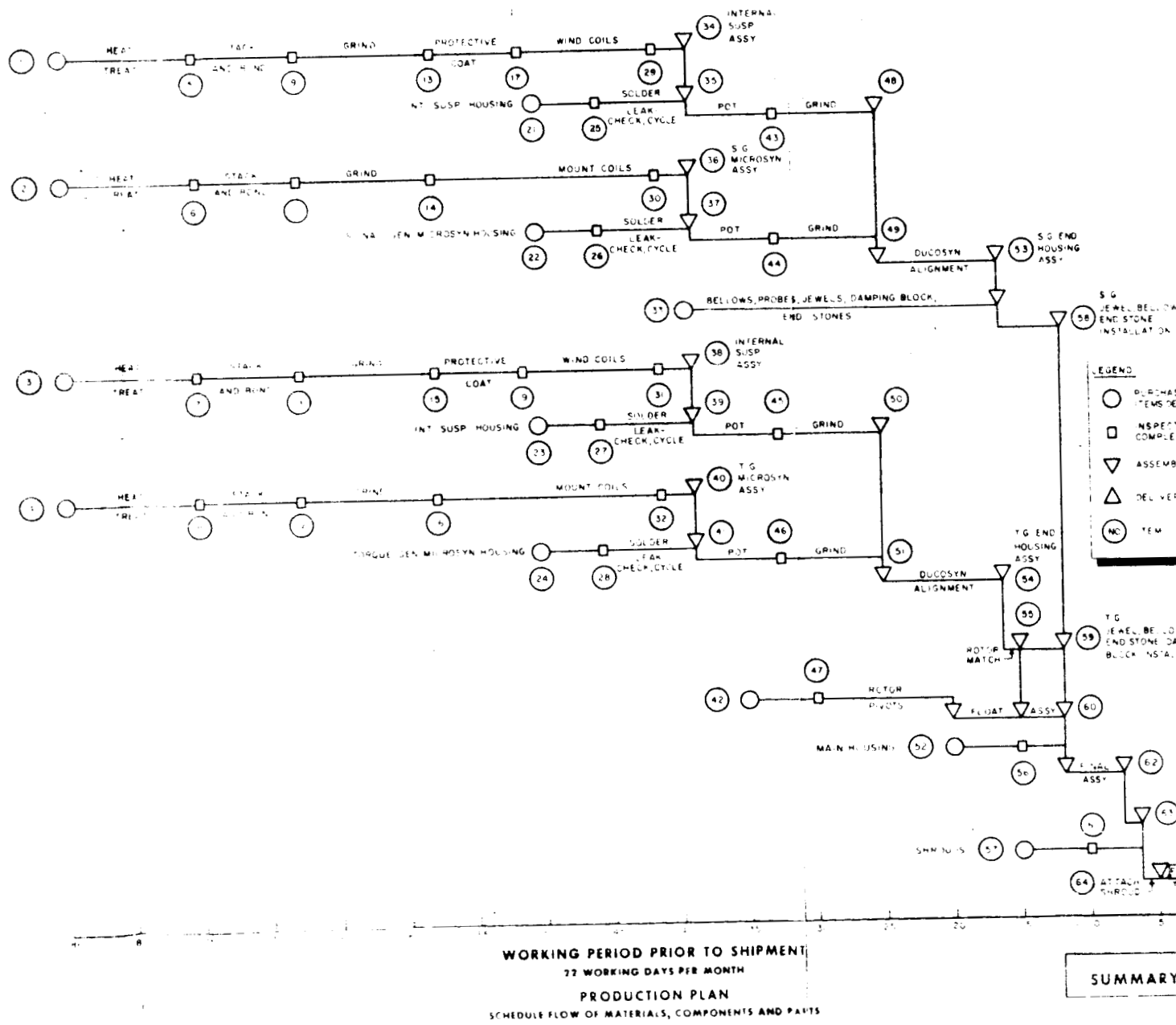
Chart No. 9 - SHEET 2
Date 3-15-63

CUMULATIVE DELIVERY SCHEDULE
(OBJECTIVE)



PRODUCTION PROGRESS
(CUMULATIVE END ITEM SETS)





ITEM NO.	DESCRIPTION
1.	DELIVERY OF TUMBLED ALFENOL LAMINATIONS
2.	DELIVERY OF TUMBLED HIPERNIK LAMINATIONS
3.	DELIVERY OF TUMBLED ALFENOL LAMINATIONS
4.	DELIVERY OF TUMBLED HIPERNIK LAMINATIONS
5.	HEAT TREATMENT OF ALFENOL LAMINATIONS
6.	HEAT TREATMENT OF HIPERNIK LAMINATIONS
7.	HEAT TREATMENT OF ALFENOL LAMINATIONS
8.	HEAT TREATMENT OF HIPERNIK LAMINATIONS
9.	STACKING AND BONDING INTERNAL SUSPENSION CORE
10.	STACKING AND BONDING MICROSYN CORE
11.	STACKING AND BONDING INTERNAL SUSPENSION CORE
12.	STACKING AND BONDING MICROSYN CORE
13.	GRIND INTERNAL SUSPENSION CORE
14.	GRIND SIGNAL-GENERATOR MICROSYN CORE
15.	GRIND INTERNAL SUSPENSION CORE
16.	GRIND TORQUE-GENERATOR MICROSYN CORE
17.	PROTECTIVE COAT INTERNAL SUSPENSION CORE
18.	NOT USED ON APOLLO
19.	PROTECTIVE COAT INTERNAL SUSPENSION CORE
20.	NOT USED ON APPOLLO
21.	DELIVER INTERNAL SUSPENSION HOUSING AND HARDWARE
22.	DELIVER SIGNAL GENERATOR HOUSING AND HARDWARE (TERMINALS)
23.	DELIVER INTERNAL SUSPENSION HOUSING AND HARDWARE
24.	DELIVER TORQUE GENERATOR HOUSING AND HARDWARE (TERMINALS)
25.	INSPECT INTERNAL SUSPENSION HOUSING AND HARDWARE
26.	INSPECT SIGNAL-GENERATOR MICROSYN HOUSING AND HARDWARE
27.	INSPECT INTERNAL SUSPENSION HOUSING AND HARDWARE
28.	INSPECT TORQUE-GENERATOR MICROSYN HOUSING AND HARDWARE
29.	WIND COILS ON INTERNAL SUSPENSION CORE
30.	MOUNT TERMINAL RING AND COILS TO SIGNAL-TORQUE MICROSYN CORE
31.	WIND COILS ON INTERNAL SUSPENSION CORE
32.	MOUNT TERMINAL RING AND COILS TO TORQUE-GENERATOR MICROSYN CORE
33.	DELIVERY OF BELLOWS, PROBES, JEWELS AND DAMPING BLOCKS

ITEM NO.	DESCRIPTION
34.	COMPLETION OF INTERNAL SUSPENSION ASSEMBLY
35.	CEMENTED INTERNAL SUSPENSION HOUSING
36.	COMPLETED SIGNAL-GENERATOR MICROSYN ASSEMBLY
37.	CEMENTED SIGNAL-GENERATOR MICROSYN HOUSING
38.	COMPLETED INTERNAL SUSPENSION ASSEMBLY
39.	CEMENTED INTERNAL SUSPENSION HOUSING
40.	COMPLETED TORQUE-GENERATOR MICROSYN ASSEMBLY
41.	CEMENTED TORQUE-GENERATOR MICROSYN HOUSING .
42.	DELIVERY OF FLOAT HARDWARE (ROTOR PIVOTS, END PLATES)
43.	POTTED INTERNAL SUSPENSION ASSEMBLY
44.	POTTED SIGNAL-GENERATOR MICROSYN ASSEMBLY
45.	POTTED INTERNAL SUSPENSION ASSEMBLY
46.	POTTED TORQUE-GENERATOR MICROSYN ASSEMBLY
47.	INSPECT HARDWARE FOR FLOAT ASSEMBLY
48.	COMPLETED INTERNAL SUSPENSION POTTED ASSEMBLY
49.	COMPLETED SIGNAL-GENERATOR POTTED MICROSYN ASSEMBLY
50.	COMPLETED INTERNAL SUSPENSION POTTED ASSEMBLY
51.	COMPLETED TORQUE-GENERATOR POTTED MICROSYN ASSEMBLY
52.	DELIVERY OF MAIN HOUSING & DETAILS
53.	SIGNAL-GENERATOR END HOUSING ASSEMBLY
54.	TORQUE-GENERATOR END HOUSING ASSEMBLY
55.	ROTOR MATCHING (WITH T.G. & I.S.)
56.	INSPECT MAIN HOUSING
57.	DELIVER SHROUDS
58.	INSTALL S.G. END STONE, JEWELS, BELLOWS
59.	INSTALL T.G. END STONE, JEWEL, BELLOWS AND DAMPING BLOCK
60.	COMPLETED FLOAT ASSEMBLY
61.	INSPECT SHROUDS
62.	UNITS IN FINAL ASSEMBLY
63.	UNIT HEATER-SENSOR CALIBRATION
64.	ATTACH SHROUD
65.	INPUT AXIS FINAL ALIGNMENT
66.	FINAL TEST (INCLUDING VIBRATION TEST)
67.	DELIVERY

WORKING PERIOD PRIOR TO SHIPMENT
22 WORKING DAYS PER MONTH

PRODUCTION PLAN
SCHEDULE FLOW OF MATERIALS, COMPONENTS AND PARTS

SUMMARY CHART

APOLLO 16 PIP MODEL D PROGRAM (R&D)

Contract NAS 9-455

Weekly Progress Report No. 32

December 10, 1962

Prepared by

Sperry Gyroscope Company
Division of Sperry Rand Corporation
Great Neck, New York

N. R. Blumenstock
Engineering Program Director

I. INTRODUCTION

This report summarizes the Sperry activities and progress achieved under Contract NAS 9-455 during the period December 3, 1962 through December 10, 1962.

II. GENERAL ACTIVITIES

A. Unit AP-4 is currently undergoing "shroud preparation" (installation of connectors, spacers, etc.) prior to shipment.

B. Units AP-5 is currently in the tank undergoing 72 hr. evacuation.

C. Unit AP-6 is being cleaned in Final Assembly.

D. Unit AP-7 is undergoing ducosyn test.

E. The revised schedule for Block 0, after the ACO #3049 correction of the rotor problem, is as follows: 2 in October, 1 in November, 3 in December and 2 in January.

F. E. Fairweather of MIT/IL called on 12/5/62 to advise that tooling dwgs. P/N MA96011 and MA96191 will replace P/N MA96207-5, 7 and 37. Also, P/N MA96009 will replace MA96730-32.

III. STATUS OF MAJOR PARTS & SUB-ASSEMBLIES

A. Status of Assembly

Unit No.	Remarks
AP-1	Delivered 10/16/62
AP-2	Delivered 10/16/62
AP-3	Delivered 11/29/62
AP-4	In "shroud preparation"
AP-5	In 72 hr. evacuation
AP-6	In final assembly
AP-7	In ducosyn test

B. Torque and Signal Generator Microsyn Assembly

	S. G. Microsyn (AP95952)		T.G. Microsyn (AP95451)	
	Total Completed (to date)	Additional Parts In Process	Total Completed (to date)	Additional Parts In Process
Stacked & Bonded P/N AP96016	12	-	11	-
Surface Grind	12	-	11	-
Mount Coils & Terminal Rings	11	-	11	-
Final Test of Micro. Assembly	11	-	11	-
Assembled into Housing	11	-	11	-
Potted, Cured & Cycled	11	-	11	-
Ground Assemblies	9	-	9	-
Inspection	7	1	7	-
Ducosyn Assembly	7	1	7	0
	S.G. Coil (AP93246)		T.G. Coil (AP93231)	
Inspection	96	-	80	-
Tested & Grouped	96	-	80	-

C. Internal Suspension Assembly

Stacked, Bonded & Ground P/N AP93239	20	-
Inspection	20	-
Durafilm	20	-
Coil Winding & Term. Assembly	20	-
Final Test of I.S. Assembly	20	-
Assembled into Housing	20	-
Potted, Cured & Cycled	19	-
Grinding	18	-
Inspection	16	-
Ducosyn Prep.	14	2

IV. PROBLEM AREAS

1. ACO 3026 stated that MIT/IL would supply external hardware (shrouds, heaters, clamp rings, etc.) for units AP-4 thru AP-8 of Block 0. These parts have not been received to date and unless they become available by 12/17/62 or a waiver is received by then, the delivery schedule for the remaining Block 0 units will be affected.

2. ACO #3030 was received by Sperry with the understanding that required companion drawings for tooling and higher assemblies also affected by the change must be revised and issued by 10 December 1962 or schedules will be adversely affected.

3. Sperry awaits MIT/IL action on the following drawings (revised list):

P/N 96189 - must be revised and issued to include manufacturing changes made by Minco Corporation per HS-169
P/N MA96191 new dwg. not delivered yet
P/N MA96011 new dwg. not delivered yet
P/N MA96009 new dwg. not delivered yet
P/N 96126 - must be revised to cover four turn reset coils
Add. D-1 to MC 1000 - must be revised to cover four turn reset coils
P/N 96302 - new dwg. not delivered yet
P/N 96303 - new dwg. not delivered yet
P/N 95944, PL95944, DCL 95944 must be revised to show all late ACO's.
P/N 96180, PL 96180, DCL 96180 must be revised to show all late ACO's.

4. Several ACO's were issued by MIT/IL at the last Change Control Board meeting without corresponding changes in related assembly drawings. In addition, several existing drawings were deactivated by ACO and superseded by new drawings which were not yet released. Sperry's configuration control system and production control procedures require simultaneous release of all affected drawings to properly control and execute a design change. Since immediate response to changes and tight control of configuration are a necessity to this program, Sperry has requested that future MIT/IL design changes include all required documentation at the time of release.

V. STATUS OF APOLLO CHANGE ORDERS

ACO#	Date Rec.	Cost Incr.	Auth Reqd.	Auth Recd.	Current Status of ACO
3026	10/5	(Decr.)	Yes	-	Released 9/26/62 in advance of auth.
3027	11/23	No	No	-	Released 11/26/62
3028	"	"	"	-	" "
3030	"	Yes	Yes	-	" " for Block II only in advance of auth.
3033	"	No	No	-	Released 11/26/62
3034	"	"	"	-	" "
3035	"	"	"	-	" "
3036	"	"	"	-	" "
3037	"	"	"	-	" "
3038	"	"	"	-	" "
3039	"	"	"	-	" "
3040	"	"	"	-	" "
3041	"	"	"	-	" "
3042	"	"	"	-	" "
3045	"	"	"	-	" "
3046	"	"	"	-	" "
3047	"	"	"	-	" "
3048	"	"	"	-	" "
3049	"	"	Yes	-	" " in advance of auth.
3050	"	"	No	-	" "
3051	"	"	"	-	" "
3052	"	"	"	-	" "

APOLLO 16 PIP MODEL D PROGRAM (R&D)

Contract NAS 9-455

Weekly Progress Report No. 33

December 17, 1962

Prepared by

Sperry Gyroscope Company
Division of Sperry Rand Corporation
Great Neck, New York

N. R. Blumenstock
Engineering Program Director

I. INTRODUCTION

This report summarizes the Sperry activities and progress achieved under Contract NAS 9-455 during the period December 11, 1962 through December 16, 1962.

II. GENERAL ACTIVITIES

A. Units AP-4 and AP-5 are currently undergoing "shroud preparation" (installation of connectors, spacers, etc.) prior to shipment.

B. Units AP-6 is currently being modified to add 3 tapped holes per MIT/IL TWX direction.

C. Unit AP-7 T.G. Microsyn has been reworked and is being checked for concentricity.

D. N. Blumenstock received and hand carried the following from MIT/IL on December 12:

Qty.	P/N	Item
6	96149	Heater and Sensor
14	96190	Element Retainer
2	95907	Shroud, Magnetic
2	96121	Cover, Magnetic
7	(TBA)	Cable Retainer
1	(TBA)	Element Retainer Fixture
1	(TBA)	Cable Installation Fixture

NOTE: The above two new fixtures are to be reviewed by Sperry and adapted as required into the manufacturing process.

E. Mr. J. Morgan attended an Apollo "Change Control Board" meeting at MIT/IL on Friday, December 14. The following ACO's were reviewed and processed:

ACO #	Title	Disposition	ACO #	Title	Disposition
3023	Filling Tank	Approved	3059	Clamp	Cancelled
3029	Terminal Ring	"	3060	Tubing Adaptor	Approved
3031	Bellows	"	3061	T.G.Microsyn Assy.	"
3032	Mult.Herm.Term.	Cancelled	3062	Assembly ("I")	"
3043	T.G.Term.Ring	Held	3063	Main Hsg.	"
3044	Parts List("O")	"	3064	Filling Tank	"
3053	Heater Sensor	Approved	3065	Fill Tank Cover	"
3054	Outline ("O")	"	3067		Cancelled
3055	Assembly ("O")	"	3068	S.G.Microsyn Assy.	Approved
3056	Outline ("I")	"	3069	Test Procedure	Cancelled
3057	Parts List ("I")	"	3070	Potted T.G. Micro.	"

F. ACO #3069 had been submitted to Sperry prior to the CCB meeting for preliminary review. Essentially, this change added the Polaris PIP Test Procedure (from #OD 23607 - Section 8) to the Apollo program with minor modifications. Since this ACO did not meet the requirements for an Apollo Test Procedure, it was cancelled by the Board. A meeting was scheduled for Monday between MIT/IL Systems and Components Group and NASA for the purpose of delineating a Static Test Procedure which will be delivered to Sperry by R. Massaro on Wednesday, 19 December.

In addition, the Monday meeting will review the availability of the Test Procedure for Block I. If this date and the length of the specified test cycle are not in agreement with Apollo PIP Milestone List then a new meeting will be scheduled at MIT/IL on Thursday, 20 December to resolve this problem.

III. STATUS OF MAJOR PARTS & SUB-ASSEMBLIES

A. Status of Assembly

Unit No.	Remarks
AP-1	Delivered 10/16/62
AP-2	Delivered 10/16/62
AP-3	Delivered 11/29/62
AP-4	In "shroud preparation"
AP-5	In "shroud preparation"
AP-6	In final assembly
AP-7	In ducosyn assembly
AP-8	In grinding operation

B. Torque and Signal Generator Microsyn Assembly

	S. G. Microsyn (AP95952)		T.G. Microsyn (AP95451)	
	Total Completed (to date)	Additional Parts In Process	Total Completed (to date)	Additional Parts In Process
Stacked & Bonded P/N AP96016	12	-	11	-
Surface Grind	12	-	11	-
Mount Coils & Terminal Rings	11	-	11	-
Final Test of Micro. Assembly	11	-	11	-
Assembled into Housing	11	-	11	-
Potted, Cured & Cycled	11	-	11	-
Ground Assemblies	9	-	9	-
Inspection	7	1	7	-
Ducosyn Assembly	7	1	7	0
	S.G. Coil (AP93246)		T.G. Coil (AP93231)	
Inspection	96	-	80	-
Tested & Grouped	96	-	80	-
C. Internal Suspension Assembly				
Stacked, Bonded & Ground P/N AP93239	20	-		
Inspection	20	-		
Durafilm	20	-		
Coil Winding & Term. Assembly	20	-		
Final Test of I.S. Assembly	20	-		
Assembled into Housing	20	-		
Potted, Cured & Cycled	19	-		
Grinding	18	-		
Inspection	16	-		
Ducosyn Prep.	14	2		

IV. PROBLEM AREAS

1. At the CCB meeting of 14 December, Mr. J. Miller of MIT/IL advised that the CFE Apollo PIP Final Test Console would not be available until 1 February 1963. This will affect current scheduling of tests for units S/N AP-7 and AP-8 in early January. MIT/IL should consider issuance of a waiver on the test requirements if the equipment cannot be made available on time.

2. Sperry awaits MIT/IL action on the following drawings (revised list):

P/N 96189 - must be revised and issued to include manufacturing changes made by Minco Corporation per HS-169
P/N MA96191 new dwg. not delivered yet
P/N MA96011 new dwg. not delivered yet
P/N MA96009 new dwg. not delivered yet
P/N 96126 - must be revised to cover four turn reset coils
Add. D-1 to MC 1000 - must be revised to cover four turn reset coils
P/N 96302 - new dwg. not delivered yet
P/N 96303 - new dwg. not delivered yet
P/N 95944, PL95944, DCL 95944 must be revised to show all late ACO's and new parts
P/N 96180, PL 96180, DCL 96180 must be revised to show all late ACO's and new part
P/N (TBA), - cable retainer - new dwg. not delivered yet
P/N (TBA) - element retainer fixture - new dwg. not delivered yet
P/N (TBA) - cable installation fixture - new dwg. not delivered yet

V. STATUS OF APOLLO CHANGE ORDERS

ACO#	Date Rec.	Cost Incr.	Auth Reqd.	Auth Recd.	Current Status of ACO
3026	10/5	(Decr.)	Yes	-	Released 9/26/62 in advance of auth.
3027	11/23	No	No	-	Released 11/26/62
3028	"	"	"	-	" "
3030	"	Yes	Yes	-	" " for Block II only in advance of auth.
3033	"	No	No	-	Released 11/26/62
3034	"	"	"	-	" "
3035	"	"	"	-	" "
3036	"	"	"	-	" "
3037	"	"	"	-	" "
3038	"	"	"	-	" "
3039	"	"	"	-	" "
3040	"	"	"	-	" "
3041	"	"	"	-	" "
3042	"	"	"	-	" "
3045	"	"	"	-	" "
3046	"	"	"	-	" "
3047	"	"	"	-	" "
3048	"	"	"	-	" "
3049	"	"	Yes	-	" " in advance of auth.
3050	"	"	No	-	" "
3051	"	"	"	-	" "
3052	"	"	"	-	" "

APOLLO 16 PIP MODEL D PROGRAM (R&D)

Contract NAS 9-455

Weekly Progress Report No. 33

December 17, 1962

Prepared by

Sperry Gyroscope Company
Division of Sperry Rand Corporation
Great Neck, New York

N. R. Blumenstock
Engineering Program Director

I. INTRODUCTION

This report summarizes the Sperry activities and progress achieved under Contract NAS 9-455 during the period December 11, 1962 through December 16, 1962.

II. GENERAL ACTIVITIES

A. Units AP-4 and AP-5 are currently undergoing "shroud preparation" (installation of connectors, spacers, etc.) prior to shipment.

B. Units AP-6 is currently being modified to add 3 tapped holes per MIT/IL TWX direction.

C. Unit AP-7 T.G. Microsyn has been reworked and is being checked for concentricity.

D. N. Blumenstock received and hand carried the following from MIT/IL on December 12

Qty.	P/N	Item
6	96149	Heater and Sensor
14	96190	Element Retainer
2	95907	Shroud, Magnetic
2	96121	Cover, Magnetic
7	(TBA)	Cable Retainer
1	(TBA)	Element Retainer Fixture
1	(TBA)	Cable Installation Fixture

NOTE: The above two new fixtures are to be reviewed by Sperry and adapted as required into the manufacturing process.

E. Mr. J. Morgan attended an Apollo "Change Control Board" meeting at MIT/IL on Friday, December 14. The following ACO's were reviewed and processed:

ACO #	Title	Disposition	ACO #	Title	Disposition
3023	Filling Tank	Approved	3059	Clamp	Cancelled
3029	Terminal Ring	"	3060	Tubing Adaptor	Approved
3031	Bellows	"	3061	T.G.Microsyn Assy.	"
3032	Mult.Herm.Term.	Cancelled	3062	Assembly ("I")	"
3043	T.G.Term.Ring	Held	3063	Main Hsg.	"
3044	Parts List("O")	"	3064	Filling Tank	"
3053	Heater Sensor	Approved	3065	Fill Tank Cover	"
3054	Outline ("O")	"	3067		Cancelled
3055	Assembly ("O")	"	3068	S.G.Microsyn Assy.	Approved
3056	Outline ("I")	"	3069	Test Procedure	Cancelled
3057	Parts List ("I")	"	3070	Potted T.G. Micro.	"

F. ACO #3069 had been submitted to Sperry prior to the CCB meeting for preliminary review. Essentially, this change added the Polaris PIP Test Procedure (from #OD 23607 - Section 8) to the Apollo program with minor modifications. Since this ACO did not meet the requirements for an Apollo Test Procedure, it was cancelled by the Board. A meeting was scheduled for Monday between MIT/IL Systems and Components Group and NASA for the purpose of delineating a Static Test Procedure which will be delivered to Sperry by R. Massaro on Wednesday, 19 December.

In addition, the Monday meeting will review the availability of the Test Procedure for Block I. If this date and the length of the specified test cycle are not in agreement with Apollo PIP Milestone List then a new meeting will be scheduled at MIT/IL on Thursday, 20 December to resolve this problem.

III. STATUS OF MAJOR PARTS & SUB-ASSEMBLIES

A. Status of Assembly

Unit No.	Remarks
AP-1	Delivered 10/16/62
AP-2	Delivered 10/16/62
AP-3	Delivered 11/29/62
AP-4	In "shroud preparation"
AP-5	In "shroud preparation"
AP-6	In final assembly
AP-7	In ducosyn assembly
AP-8	In grinding operation

B. Torque and Signal Generator Microsyn Assembly

	S. G. Microsyn (AP95952)		T.G. Microsyn (AP95451)	
	Total Completed (to date)	Additional Parts In Process	Total Completed (to date)	Additional Parts In Process
Stacked & Bonded P/N AP96016	12	-	11	-
Surface Grind	12	-	11	-
Mount Coils & Terminal Rings	11	-	11	-
Final Test of Micro. Assembly	11	-	11	-
Assembled into Housing	11	-	11	-
Potted, Cured & Cycled	11	-	11	-
Ground Assemblies	9	-	9	-
Inspection	7	1	7	-
Ducosyn Assembly	7	1	7	0
	S.G. Coil (AP93246)		T.G. Coil (AP93231)	
Inspection	96	-	80	-
Tested & Grouped	96	-	80	-
C. Internal Suspension Assembly				
Stacked, Bonded & Ground P/N AP93239	20	-		
Inspection	20	-		
Durafilm	20	-		
Coil Winding & Term. Assembly	20	-		
Final Test of I.S. Assembly	20	-		
Assembled into Housing	20	-		
Potted, Cured & Cycled	19	-		
Grinding	18	-		
Inspection	16	-		
Ducosyn Prep.	14	2		

IV. PROBLEM AREAS

1. At the CCB meeting of 14 December, Mr. J. Miller of MIT/IL advised that the CFE Apollo PIP Final Test Console would not be available until 1 February 1963. This will affect current scheduling of tests for units S/N AP-7 and AP-8 in early January. MIT/IL should consider issuance of a waiver on the test requirements if the equipment cannot be made available on time.

2. Sperry awaits MIT/IL action on the following drawings (revised list):

P/N 96189 - must be revised and issued to include manufacturing changes made by Minco Corporation per HS-169
P/N MA96191 new dwg. not delivered yet
P/N MA96011 new dwg. not delivered yet
P/N MA96009 new dwg. not delivered yet
P/N 96126 - must be revised to cover four turn reset coils
Add. D-1 to MC 1000 - must be revised to cover four turn reset coils
P/N 96302 - new dwg. not delivered yet
P/N 96303 - new dwg. not delivered yet
P/N 95944, PL95944, DCL 95944 must be revised to show all late ACO's and new parts
P/N 96180, PL 96180, DCL 96180 must be revised to show all late ACO's and new part
P/N (TBA), - cable retainer - new dwg. not delivered yet
P/N (TBA) - element retainer fixture - new dwg. not delivered yet
P/N (TBA) - cable installation fixture - new dwg. not delivered yet

V. STATUS OF APOLLO CHANGE ORDERS

ACO#	Date Rec.	Cost Incr.	Auth Reqd.	Auth Recd.	Current Status of ACO
3026	10/5	(Decr.)	Yes	-	Released 9/26/62 in advance of auth.
3027	11/23	No	No	-	Released 11/26/62
3028	"	"	"	-	" "
3030	"	Yes	Yes	-	" " for Block II only in advance of auth.
3033	"	No	No	-	Released 11/26/62
3034	"	"	"	-	" "
3035	"	"	"	-	" "
3036	"	"	"	-	" "
3037	"	"	"	-	" "
3038	"	"	"	-	" "
3039	"	"	"	-	" "
3040	"	"	"	-	" "
3041	"	"	"	-	" "
3042	"	"	"	-	" "
3045	"	"	"	-	" "
3046	"	"	"	-	" "
3047	"	"	"	-	" "
3048	"	"	"	-	" "
3049	"	"	Yes	-	" " in advance of auth.
3050	"	"	No	-	" "
3051	"	"	"	-	" "
3052	"	"	"	-	" "

APOLLO 16 PIP MODEL D PROGRAM (R&D)

Contract NAS 9-455

Weekly Progress Report No. 34

December 24, 1962

Prepared by

Sperry Gyroscope Company
Division of Sperry Rand Corporation
Great Neck, New York

N. R. Blumenstock
Engineering Program Director

I. INTRODUCTION

This report summarizes the Sperry activities and progress achieved under Contract NAS 9-455 during the period December 17, 1962 through December 23, 1962.

II. GENERAL ACTIVITIES

A. Units AP-4 and AP-5 are completed in accordance with latest instructions and currently awaiting shipment.

B. Unit AP-6 is currently being pumped down (72 hour evacuation).

C. Unit AP-7 T.G. Micresyn is currently undergoing T.G. temperature cycling in ducosyn assembly.

D. Unit AP-8 T.G. Micresyn has not completed grinding as yet.

E. R. Massare of MIT/IL visited Sperry on Thursday, December 20, for the purpose of observing the Polaris Final Test Console operation. While here, he discussed the Apolle Test Procedure availability problem. In lieu of a written Technical Directive, Mr. Massare instructed Sperry to perform the static portion of the final test procedure in OD23607 for Apolle units #AP-7 and AP-8. These verbal instructions were to be formalized as soon as possible.

III. STATUS OF MAJOR PARTS & SUB-ASSEMBLIES

A. Status of Assembly

Unit No.	Remarks
AP-1	Delivered 10/16/62
AP-2	Delivered 10/16/62
AP-3	Delivered 11/29/62
AP-4	Awaiting delivery
AP-5	Awaiting delivery
AP-6	In 72 hour evacuation
AP-7	In ducosyn assembly
AP-8	In grinding operation

B. Torque and Signal Generator Microsyn Assembly - Block "O"

	S.G. Microsyn (AP95952)		T.G. Microsyn (AP95451)	
	Total Completed (to date)	Additional Parts In Process	Total Completed (to date)	Additional Parts In Process
Stacked & Bonded P/N AP96016	12	-	11	-
Surface Grind	12	-	11	-
Mount Coils & Terminal Rings	11	-	11	-
Final Test of Micro. Assembly	11	-	11	-
Assembled into Housing	11	-	11	-
Potted, Cured & Cycled	11	-	11	-
Ground Assemblies	9	-	9	1
Inspection	8	-	7	-
Ducosyn Assembly	8	-	7	-
	S.G. Coil (AP93246)		T.G. Coil (AP93231)	
Inspection	96	-	80	-
Tested & Grouped	96	-	80	-

C. Torque & Signal Generator Microsyn Assembly - Block I

Stacked & Bonded IAP96016	21	-	5	-
Surface Grind	21	-	5	-
Mount Coils & Terminal Rings	-	21	-	5
	S.G. Coil (IAP96127)		T.G. Coil (IAP96131)	
Inspection	30	-	2	-
Tested & Grouped	30	-	2	-

D. Internal Suspension Assembly	Block "O"		Block "I"	
Stacked, Bonded & Ground P/N AP93239	20	-	52	-
Inspection	20	-	52	-
Durafilm	20	-	21	31
Coil Winding & Term. Assembly	20	-	-	21
Final Test of I.S. Assembly	20	-	-	-
Assembled into Housing	20	-	-	-
Potted, Cured & Cycled	19	-	-	-
Grinding	18	-	-	-
Inspection	16	-	-	-
Ducosyn Prep.	16	-	-	-

IV. PROBLEM AREAS

1. At the CCB meeting of 14 December, Mr. J. Miller of MIT/IL had advised that the CFE Apollo PIP Final Test Console would not be available for dynamic tests until 1 February 1963. Actually, the console will be completed by Dec. 31, but will be only useful for "open loop" testing. This means it must be retrofitted in January for Apollo dynamic testing.

2. Sperry awaits MIT/IL action on the following drawings (revised list):

P/N 96189 - must be revised and issued to include manufacturing changes made by Mince Corporation per HS-169
P/N MA96191 new dwg. not delivered yet
P/N MA96011 new dwg. not delivered yet
P/N MA96009 new dwg. not delivered yet
P/N 96126 - must be revised to cover four turn reset coils
Add. D-1 to MC 1000 - must be revised to cover four turn reset coils
*P/N 96302 - new dwg. not delivered yet
*P/N 96303 - new dwg. not delivered yet
*NOTE - These are critical since ACO's "deactivated" the existing connector prints on Nov. 23, 1962.
DCL 95944 must be revised to show all late ACO's and new parts
P/N 96180, PL 96180, DCL 96180 must be revised to show all late ACO's and new parts
P/N (TBA), - cable retainer - new dwg. not delivered yet
P/N (TBA) - element retainer fixture - new dwg. not delivered yet
P/N (TBA) - cable installation fixture - new dwg. not delivered yet
P/N 93237 - must be revised for ACO 3029
P/N 95925 - must be revised for ACO 3054
P/N 96059 - must be revised for ACO 3068
P/N 96141 - must be revised for ACO 3056
P/N MA96141-2 - must be revised for ACO 3064
P/N 96126 - must be revised for ACO 3061
P/N 96141-3 - must be revised for ACO 3065
P/N 99141-1 - must be revised for ACO 3023

3. The following items are reported as possible problem areas which should be reviewed by MIT/IL for possible action:

a. Tolerance build-up on the P/N 95913 float assembly permits a possible .025" interference between the P/N 96014 rotor and the float end plate P/N 93211. Although this has not occurred to date, it is possible and could cause scrappage when it does occur.

b. The P/N 95913 float assembly for unit #AP-2 did not require any adjustment for pendulosity. This would seem to indicate the present design is on the borderline of pendulosity adjustment capability.

c. The P/N 95913 float assembly for unit #AP-5 did not require the installation of any flotation screws P/N 93213 to achieve neutral buoyancy. This would seem to indicate that the present design is on the borderline of neutral buoyancy adjustment with the flotation screws that are available.

d. Tolerance build up between the threads of the stop screw P/N 96005, the pendulous weight P/N 96006, and the float body bore permits inclination of the stop screw from the perpendicular to the IA and OA axes. This has resulted so far in maximum inclinations of 2° 29' in the PRA Input axis plane and 2° 42' in the PRA output axis plane which occurred in unit #AP-4. There is no existing specification on this perpendicularity therefore it is suggested that dimensions be placed on the bottom of the stop screw defining the perpendicularity of its longitudinal axis and flatness plus a similar definition for the threaded bore of the float.

e. The present distribution of end stones available under P/N 93256 (dash 1 thru 9) provides for adjustment in .0004" steps. The MC procedure in Addendum D-1 to MC1000 requires adjustment to .0002". It is suggested that additional dash numbers be provided to accommodate this requirement.

4. In order to accommodate the static portion of the Apollo Final Tests to units #AP-7 and AP-8, authorization in the form of an ACO and Contracting Officers letter should be made available to Sperry by January 4, 1963. In addition, a preliminary final test procedure for block I is required by February 1 and the complete final version by February 15 in order to meet schedules.

5. The heater sensor element retaining fixture (P/N "TBA"), supplied by MIT/IL last week was placed in service. The first unit assembled by this method unfortunately had the heater-sensor element wires pinched during the operation. Rework of the fixture eleminated the problem but the heater-sensor element for unit AP-4 had to be scrapped.

6. Sperry investigation of the one-bottle filling technique indicates that the volume of one bottle of damping fluid is insufficient to fill the fluid reservoir and associated plumbing as required to permit a pressure-fill. This pressure filling will be mandatory for Block I, therefore redesign of this filling fixture will be necessary. A Sperry engineering change request will follow.

7. The previous request for companion tooling and higher assembly dwgs. for ACO #3030 by December 10 should be amended to Jan. 2, since the decision was made to break this change into Block II.

V. STATUS OF APOLLO CHANGE ORDERS

ACO #	Date Rec.	Cost Incr.	Auth. Reqd.	Auth. Recd.	Current Status of ACO
3023	12/18	No	No	-	Released 12/19/62
3026	10/5	(Decr.)	Yes	-	Released 9/26/62 in advance of auth.
3027	11/23	No	No	-	Released 11/26/62
3028	"	"	"	-	" "
3029	12/18/62	"	"	-	Released 12/19/62
3030	11/23/62	Yes	Yes	-	Released 11/26/62 for block II only in advance of auth.

3033	11/23	No	No	-	Released	11/26/62
3034	"	"	"	-	"	"
3035	"	"	"	-	"	"
3036	"	"	"	-	"	"
3037	"	"	"	-	"	"
3038	"	"	"	-	"	"
3039	"	"	"	-	"	"
3040	"	"	"	-	"	"
3041	"	"	"	-	"	"
3042	"	"	"	-	"	"
3044	12/18	"	"	-	"	12/19/62
3045	11/23	"	"	-	"	11/26/62
3046	"	"	"	-	"	"
3047	"	"	"	-	"	"
3048	"	"	"	-	"	"
3049	"	"	Yes	-	"	" in advance of auth.
3050	"	"	No	-	"	"
3051	"	"	"	-	"	"
3052	"	"	"	-	"	"
3054	12/18	"	"	-	"	12/19/62
3056	"	"	"	-	"	"
3061	"	"	"	-	"	"
3064	"	"	"	-	"	"
3065	"	Yes	Yes	-	"	" in advance of auth.
3068	"	No	No	-	"	"

APOLLO 16 PIP MODEL D PROGRAM (R&D)

Contract NAS 9-455

Weekly Progress Report No. 35

December 31, 1962

Prepared by

Sperry Gyroscope Company
Division of Sperry Rand Corporation
Great Neck, New York

N. R. Blumenstock
Engineering Program Director

I. INTRODUCTION

This report summarizes the Sperry activities and progress achieved under Contract NAS 9-455 during the period December 24, 1962 through December 30, 1962.

II. GENERAL ACTIVITIES

A. Units AP-4 and AP-5 were accepted by INSMAT for NASA and are currently awaiting shipment.

B. Unit AP-6 is currently undergoing a filling operation.

C. Unit AP-7 T.G. Micresyn is in ducosyn assembly.

D. Unit AP-8 T.G. Micresyn is expected to complete grinding at American Beryllium this coming week.

E. The following Apollo Change Orders were received from MIT/IL on Thursday, December 27:

ACO #	P/N	Description	Sperry Change Committee Act.
3031	93255	Bellows-Updating	Approved and released
3043	96132	T.G. Term. Ring -Minor chg.	Approved for Blk II rel.only
3053	96149	Heater/Senser-Updating	Approved and released
3057	PLMA96180	Tool Pts. List-Updating	Approved and released
3060	MA96664-4	Tubing Adpter-Inactivate	Approved & rel. for Blk I act
3062	96180	Assy. Dwg. Updating	" " "
3063	95904	Main Hsg.-Add tapped holes	" " "

III. STATUS OF MAJOR PARTS & SUB-ASSEMBLIES

A. Status of Assembly

Unit No.	Remarks
AP-1	Delivered 10/16/62
AP-2	Delivered 10/16/62
AP-3	Delivered 11/29/62
AP-4	Awaiting delivery
AP-5	Awaiting delivery
AP-6	In 72 hour evacuation
AP-7	In ducosyn assembly
AP-8	In grinding operation

B. Torque and Signal Generator Microsyn Assembly - Block "O"

	S.G. Microsyn (AP95952)		T.G. Microsyn (AP95451)	
	Total Completed (to date)	Additional Parts In Process	Total Completed (to date)	Additional Parts In Process
Stacked & Bonded P/N AP96016	12	-	11	-
Surface Grind	12	-	11	-
Mount Coils & Terminal Rings	11	-	11	-
Final Test of Micro. Assembly	11	-	11	-
Assembled into Housing	11	-	11	-
Potted, Cured & Cycled	11	-	11	-
Ground Assemblies	9	-	9	1
Inspection	8	-	7	-
Ducosyn Assembly	8	-	7	-
	S.G. Coil (AP93246)		T.G. Coil (AP93231)	
Inspection	96	-	80	-
Tested & Grouped	96	-	80	-

C. Torque & Signal Generator Microsyn Assembly - Block I

Stacked & Bonded IAP96016	21	-	5	-
Surface Grind	21	-	5	-
Mount Coils & Terminal Rings	-	21	-	5
	S.G. Coil (IAP96127)		T.G. Coil (IAP96131)	
Inspection	30	-	2	-
Tested & Grouped	30	-	2	-

D. Internal Suspension Assembly	Block "O"		Block "I"	
Stacked, Bonded & Ground P/N AP93239	20	-	52	-
Inspection	20	-	52	-
Durafilm	20	-	21	31
Coil Winding & Term. Assembly	20	-	-	21
Final Test of I.S. Assembly	20	-	-	-
Assembled into Housing	20	-	-	-
Potted, Cured & Cycled	19	-	-	-
Grinding	18	-	-	-
Inspection	16	-	-	-
Ducosyn Prep.	16	-	-	-

IV. PROBLEM AREAS

1. Unit #AP-6 was found to be bubbling or gassing during pressure cycling from 20 millimeters to 5 millimeters on Thursday and Friday. Since the bubbling continued without abatement, Unit AP-6 will be disassembled and investigated further at this point to determine the source of the gassing.

V. STATUS OF APOLLO CHANGE ORDERS

ACO #	Date Rec.	Cost Incr.	Auth. Reqd.	Auth. Recd.	Current Status of ACO
3023	12/18	No	No	-	Released 12/19/62
3026	10/5	(Decr.)	Yes	-	Released 9/26/62 in advance of auth.
3027	11/23	No	No	-	Released 11/26/62
3028	"	"	"	-	" "
3029	12/18	"	"	-	" 12/19/62
3030	11/23	Yes	Yes	-	Held for auth.
3031	12/27	No	No	-	Released 12/28/62
3033	11/23	No	No	-	" 11/26/62
3034	"	"	"	-	" "
3035	"	"	"	-	" "
3036	"	"	"	-	" "
3037	"	"	"	-	" "
3038	"	"	"	-	" "
3039	"	"	"	-	" "
3040	"	"	"	-	" "
3041	"	"	"	-	" "
3042	"	"	"	-	" "
3043	12/27	TBA	Yes	-	Held for auth.
3044	12/18	No	No	-	" 12/19/62
3045	11/23	"	"	-	" 11/26/62
3046	"	"	"	-	" "
3047	"	"	"	-	" "
3048	"	"	"	-	" "
3049	"	"	Yes	-	" " in adv. of auth.
3050	"	"	No	-	" "
3051	"	"	"	-	" "
3052	"	"	"	-	" "
3053	12/27	No	No	-	" 12/28/62
3054	12/18	"	"	-	" 12/19/62
3055	12/27	"	"	-	" 12/28/62
3056	12/18	"	"	-	" 12/19/62
3057	12/27	"	"	-	" 12/28/62
3060	12/27	"	"	-	" "
3061	12/18	"	"	-	" 12/19/62
3063	12/27	Yes	Yes	-	Held for auth.
3064	12/18	No	No	-	" 12/19/62
3065	"	Yes	Yes	-	" " in adv. of auth.
3068	"	No	No	-	" "

APOLLO 16 PIP MODEL D PROGRAM (R&D)

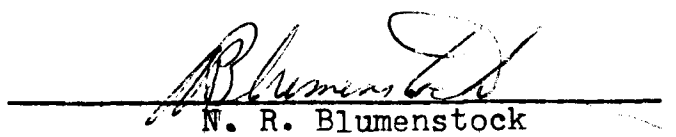
Contract NAS 9-455

Weekly Progress Report No. 36

January 7, 1963

Prepared by

Sperry Gyroscope Company
Division of Sperry Rand Corporation
Great Neck, New York



N. R. Blumenstock
Engineering Program Director

I. INTRODUCTION

This report summarizes the Sperry activities and progress achieved under Contract NAS 9-455 during the period December 31, 1962 through January 6, 1963.

II. GENERAL ACTIVITIES

A. Units AP-4 and AP-5 were delivered to MIT/IL on 12/31/62.

B. Unit AP-6 has been disassembled to investigate a gassing problem. After recleaning, it was recycled into the 72 hour evacuation operation.

C. Unit AP-7 T.G. Microsyn remains in ducosyn assembly for investigation of a concentricity problem.

D. Unit AP-8 T.G. Microsyn is expected to complete grinding at American Beryllium by January 7, 1963.

E. The following Apollo Van Dyke drawings were received from MIT/IL on Thursday, January 3, 1963:

P/N	Description
MA96009	Float Support Assembly
MA96011	Assembly Tube
MA96191	Bracket Assembly

F. Messrs. John Morgan and C. Willette conducted a surveillance trip 1/3/63 to Danco Tool and Mold Co., Phoenixville, Pennsylvania, to review stator core problems (see Problem Areas, Item C).

III. STATUS OF MAJOR PARTS & SUB-ASSEMBLIES

A. Status of Assembly

Unit No.	Remarks
AP-1	Delivered
AP-2	Delivered
AP-3	Delivered
AP-4	Delivered
AP-5	Delivered
AP-6	In 72 hour evacuation
AP-7	In ducosyn assembly
AP-8	In grinding operation

B. Torque and Signal Generator Microsyn Assembly - Block "0"

	Total Completed (to date)	Additional Parts in Process	Total Completed (to date)	Additional Parts in Process
Stacked & Bonded P/N AP96016	12	-	11	-
Surface Grind	12	-	11	-
Mount Coils & Terminal Rings	11	-	11	-
Final Test of Micro. Assembly	11	-	11	-
Assembled into Housing	11	-	11	-
Potted, cured & Cycled	11	-	11	-
Ground Assemblies	9	-	9	-
Inspection	8	-	7	-
Ducosyn Assembly	8	-	7	-
	S.G. Coil (AP93246)		T.G. Coil (AP93231	
Inspection	96	-	80	-
Tested & Grouped	96	-	80	-

C. Torque & Signal Generator Microsyn Assembly - Block I

Stacked & Bonded IAP96016	21	-	5	-
Surface Grind	21	-	5	-
Mount Coils & Terminal Rings	9	12	-	5
	S.G. Coil (IAP96127)		T.G. Coil (IAP96131	
Inspection	30	-	2	-
Tested & Grouped	30	-	2	-

D. Internal Suspension Assembly

	Block "0"		Block "I"	
Stacked, Bonded & Ground P/N AP93239	20	-	52	-
Inspection	20	-	52	-
Durafilm	20	-	21	31
Coil Winding & Term. Assembly	20	-	5	16
Final Test of I.S. Assembly	20	-	-	-
Potted, Cured & Cycled	19	-	-	-
Grinding	18	-	-	-
Inspection	16	-	-	-
Ducosyn Prep.	16	-	-	-

IV. STATUS OF APOLLO CHANGE ORDERS

ACO #	Date Rec'd.	Cost Incr.	Auth. Req'd.	Auth. Rec'd.	Current Status of ACO
3023	12/18	No	No	-	Released 12/19/62
3026	10/5	(Decr.)	Yes	-	Released 9/26/62 in advance of auth.
3027	11/23	No	No	-	Released 11/26/62
3028	"	"	"	-	" "
3029	12/18	"	"	-	" 12/19/62
3030	11/23	Yes	Yes	-	Held for auth.
3031	12/27	No	No	-	Released 12/28/62
3033	11/23	No	No	-	" 11/26/62
3034	"	"	"	-	" "
3035	"	"	"	-	" "
3036	"	"	"	-	" "
3037	"	"	"	-	" "
3038	"	"	"	-	" "
3039	"	"	"	-	" "
3040	"	"	"	-	" "
3041	"	"	"	-	" "
3042	"	"	"	-	" "
3043	12/27	TBA	Yes	-	Held for auth.
3044	12/18	No	No	-	Released 12/19/62
3045	11/23	"	"	-	" 11/26/62
3046	"	"	"	-	" "
3047	"	"	"	-	" "
3048	"	"	"	-	" "
3049	"	"	Yes	-	" " in advance of auth.
3050	"	"	No	-	Released 11/26/62
3051	"	"	"	-	" "
3052	"	"	"	-	" "
3053	12/27	No	No	-	" 12/28/62
3054	12/18	"	"	-	" 12/19/62
3055	12/27	"	"	-	" 12/28/62
3056	12/18	"	"	-	" 12/19/62
3057	12/27	"	"	-	" 12/28/62
3060	12/27	"	"	-	" "
3061	12/18	"	"	-	" 12/19/62
3063	12/27	Yes	Yes	-	Held for auth.
3064	12/18	No	No	-	Released 12/19/62
3065	"	Yes	Yes	-	" " in advance of auth.
3068	"	No	NO	-	Rleased 12/19/62

V. PROBLEM AREAS

A. Unit #AP-6 was disassembled as a result of the gassing problem previously mentioned. It was decided that a complete investigation in detail to determine the source of the gassing could not be performed at this time without further effect on schedule. Instead, the unit was subjected to a thorough cleaning and then recycled into assembly and the "72 hour evacuation". Results of this action will be reported next week.

B. Tool drawings (Van Dykes) of the Float Support Assembly P/N MA96009, Assembly Tube P/N MA96011, and Bracket Assembly P/N MA96191 were received last week from MIT/IL. All three are apparently superceded prints unchanged from the original issue. A problem still exists therefore, due to the following:

1. In November, an unofficial copy of the new filling tank fixture print #MA96207-1 was given to Sperry during a visit to MIT/IL. This print called out new P/N's for the Float Clamp Assembly MA96730-32, the Assembly Tube MA96207-7, and the Bracket Assembly MA96207-5. The official copies of these prints were to be released later.

2. The filling fixture has been modified in accordance with MA96730-1 (unofficial) but detail changes are unknown at this point.

3. Sperry listed P/N's MA96009, MA96011, and MA96191 erroneously as missing. What was needed, of course, were the new or updated versions.

C. Recently received lamination stacks from Danco Tool Co. appeared to be oversize and to have low permeability. This was checked out at Danco by J. Morgan and C. Willette as follows:

1. Poor registration of the lams in the stacks was caused by an improper set-up of the dies. This was a random operation and resulted in the O.D. being out of concentricity with the I.D. Since the stacks were piloted on the I.D., the O.D. of various lams appeared to have shifted and the stack O.D. appeared too large. This problem was immediately rectified and the nine affected stacks from Sperry were reworked by Danco.

2. The permeability problem developed as follows:

   - MIT/IL specifies "Hypernik" on manufacturing drawings for lam stacks. Permeability is not specified but heat treat is. Westinghouse is listed as the supplier.

   - Sperry purchases "Hypernik" type material in accordance with Sperry Standard MFA which includes a comprehensive purchase specification that defines required flux density, chemical composition, permeability, etc. Sperry experience

indicates that Carpenter Steel #49 (4750 alloy) is an excellent source of "Hypernik" type material.

- Danco had standardized on Carpenter Steel #49 material since it is thoroughly checked and certified by Carpenter prior to delivery as to permeability, etc. Danco inspection of received material has verified this.

- Apollo PIP lamination material was received from Westinghouse by Danco and found to have permeability approximately 50% lower than the Carpenter Steel #49 alloy. Since the MIT/IL prints did not specify permeability, Danco used the Hypernik as is.

- MIT/IL (Mr. Lou Eichenger) found that these microsyn cores had permeability four times lower than normal and advised Sperry.

- Sperry visited Danco to investigate. Westinghouse was contacted (Mr. Don Del Frate) and admitted that their certification was a mimeograph form which stated the chemical properties of their Hypernik and the maximum permeability in the hard condition. The space for permeability after annealing was not filled in. Westinghouse agreed to fill in this information on future batches and that the pereability should have been higher. They recommended a long (10 hour) additional heat treat which appears to be of doubtful value.

- Mr. Lou Eichenger of MIT/IL was contacted and agreed to issue more stringent specifications such as Sperry MFA. He recommened that Sperry use existing microsyns as is and suggested that the Hypernik may be prone to permeability changes due to handling after heat treat. He did not believe that this low pereability would be an important factor.

- Danco will now use Carpenter #49 for Sperry Apollo PIP's.

- Sperry obtained ring samples of Westinghouse Hypernik both before and after heat treat, Carpenter Steel #49, and Alleghany Ludlum #4750 for metalurgical tests and chemical analyses. Possible reductions in permeability due to handling will also be investigated.

D. The Milestone date for the release of Block II documentation was January 2, 1963. Any further delay in receipt of these drawings and the MC1500 Test Specification will undoubtedly have an effect on schedules.

E. Sperry contacted Mr. Lou Eichenger of MIT/IL relative to use of Mylar tape instead of Durafilm under the preset coil windings. The first couple of Block I T.G. Microsyns assembled with the

reset coils wound on Durafilm coating suffered "megger" failures. Mr. Eichenger had agreed to the preparation of several units with Mylar tape. This arrangement looks good and should be incorporated as soon as possible. Sperry will prepare a Change Request for this item

F. Please correct the interference stated in Problem Area #3a of December 24th report. It should be ".0025" and not".025".

APOLLO 16 PIP MODEL D PROGRAM (R&D)

Contract NAS 9-455

Weekly Progress Report No. 37

January 14, 1963

Prepared by

Sperry Gyroscope Company
Division of Sperry Rand Corporation
Great Neck, New York

N. R. Blumenstock
Engineering Program Director

I. INTRODUCTION

This report summarizes the Sperry activities and progress achieved under Contract NAS 9-455 during the period January 7, 1963 through January 13, 1963.

II. GENERAL ACTIVITIES

A. Unit #AP-6 was successfully cleaned, reassembled, and filled without any sign of bubbling or gassing. It is now in Final Assembly. It was determined that the "72 hour evacuation" had been interrupted and this probably caused the gassing problem.

B. Unit #AP-7 concentricity problem has been resolved in ducosyn assembly. It has now been placed into floatation.

C. Unit #AP-8 T.G. Microsyn has been received from grinding at American Beryllium on 1/10/63 and is now undergoing Incoming Inspection.

D. Twenty-nine revised Apollo PIP drawings for Blocks "O" and "I" were received from MIT/IL on January 8, 1963 and 8 more on January 11, 1963. Thirty-two were released without problem. The remaining five involve various problems discussed under Problem Areas Section V.

E. A Technical Meeting was held at Sperry on Wednesday, January 8, attended by MIT/IL, NASA, and Sperry. Attending were: Mr. W. Rhine of NASA, Mr. John Miller of MIT/IL, and Messrs: R. Hannah, N. Blumenstock, J. Morgan and J. McCooey of Sperry. Availability of Final Test Equipment and Test Specifications was reviewed in detail. In addition, block schedules and other problems were covered. See attached Minutes of Meeting (4 pages)

III. STATUS OF MAJOR PARTS & SUB-ASSEMBLIES

A. Status of Assembly

Unit No.	Remarks
AP-1	Delivered
AP-2	"
AP-3	"
AP-4	"
AP-5	"
AP-6	In final assembly
AP-7	In floatation
AP-8	In ducosyn assembly

B. Torque and Signal Generator Microsyn Assembly - Block "0"

	Total Completed (to date)	Additional Parts in Process	Total Completed (to date)	Additional Parts in Process
Stacked & Bonded P/N AP96016	12	-	11	-
Surface Grind	12	-	11	-
Mount Coils & Terminal Rings	11	-	11	-
Final Test of Micro. Assembly	11	-	11	-
Assembled into Housing	11	-	11	-
Potted, cured & cycled	11	-	11	-
Ground Assemblies	9	-	10	-
Inspection	8	-	8	-
Ducosyn Assembly	8	-	7	1
	S.G. Coil (AP93246)		T.G. Coil (AP93231)	
Inspection	96	-	80	-
Tested & Grouped	96	-	80	-

C. Torque & Signal Genrator Microsyn Assembly - Block I

Stacked & Bonded IAP96016	26	-	25	-
Surface Grind	26	-	25	-
Mount Coils & Terminal Rings	17	8	-	25
	S.G. Coil (IAP 96127)		T.G. Coil (IAP96131)	
Inspection	25	-	25	-
Tested & Grouped	25	-	25	-

D. Internal Suspension Assembly Block "0" Block "I"

Stacked, Bonded & Ground P/N AP93239	20	-	52	-
Inspection	20	-	52	-
Durafilm	20	-	21	31
Coil Winding & Term. Assembly	20	-	21	16
Final Test of I.S. Assembly	20	-	21	-
Impregnation	-	-	7	14
Assembled into Housing	-	-	7	-
Potted, Cured & Cycled	19	-	-	7
Grinding	18	-	-	-
Inspection	16	-	-	-
Ducosyn Prep.	16	-	-	-

IV. STATUS OF APOLLO CHANGE ORDERS

ACO #	Date Rec'd.	Cost Incr.	Auth. Req'd.	Auth. Rec'd.	Current Status of ACO
3028	12/18	No	No	-	Released 12/19/62
3026	10/5	(Decr.)	Yes	-	Released 9/26/62 in advance of auth.
3027	11/23	No	No	-	Released 11/26/62
3028	"	"	"	-	" "
3029	12/18	"	"	-	" 12/19/62
3030	11/23	Yes	Yes	-	Held for auth.
3031	12/27	No	No	-	Released 12/28/62
3033	11/23	"	"	-	" 11/26/62
3034	"	"	"	-	" "
3035	"	"	"	-	" "
3036	"	"	"	-	" "
3037	"	"	"	-	" "
3038	"	"	"	-	" "
3039	"	"	"	-	" "
3040	"	"	"	-	" "
3041	"	"	"	-	" "
3042	"	"	"	-	" "
3043	12/27	TBA	Yes	-	Held for auth.
3044	12/18	No	No	-	Released 12/19/62
3045	11/23	"	"	-	" 11/26/62
3046	"	"	"	-	" "
3047	"	"	"	-	" "
3048	"	"	"	-	" "
3049	"	"	Yes	-	" " in advance of auth.
3050	"	"	No	-	" "
3051	"	"	"	-	" "
3052	"	"	"	-	" "
3053	12/27	"	"	-	" 12/28/62
3054	12/18	"	"	-	" 12/19/62
3055	12/27	"	"	-	" 12/28/62
3056	12/18	"	"	-	" 12/19/62
3057	12/27	"	"	-	" 12/28/62
3060	12/27	"	"	-	" "
3061	12/18	"	"	-	" 12/19/62
3062	12/27	"	"	-	" 12/28/62
3063	"	Yes	Yes	-	Held for auth.
3064	12/18	No	No	-	Released 12/19/62
3065	"	Yes	Yes	-	" " in advance of auth.
3068	"	No	No	-	" "

V. PROBLEM AREAS

A. Drawing problems associated with drawings received January 8, and 11, 1963:

#96180A - Two Change Orders #3046 and 3062 were assigned the same revision sub-letter. ACO #3046 was received 11/23/62 and #3062 on 12/27/62. Each change should have been assigned a separate revision letter since they were not issued simultaneously, however, since the revision A drawing incorporating both changes has now been received, Sperry has accepted the single sub-letter revision.

#95921E - ACO #3028 specified etching of serial numbers in 1/8" high characters but rev. E of this dwg. does not conform to this requirement. This dwg. is now being held pending further MIT/IL instructions.

#95913E - ACO #3027 added note "Match Mark per (MC1500) Addendum D-1 to MC 1000" but rev. E of the dwg. does not contain this information. In addition, section YY as shown in ACO # 3027 does not appear on the print. This dwg. is now being held pending further instructions from MIT/IL.

#95904G - ACO #3037 revised dwg. #95904 to G in Nov. 1962. ACO #3063, when received on 12/27/62 also revised dwg. #95904 to G. Since our subcontractors are involved in this part, it was urgent that each modification be identified by a separate subletter. Mr. R. Cooper was contacted re this problem and agreed to changing the subletter to H before release at Sperry. This was done, however, the revised print #95904G arrived and it incorporates ACO #3063. This dwg. is now being held pending further clarification from MIT/IL.

#MA96670B As received on Jan. 11, this print is listed as being revised per ECO #1278 and applicable to 16 PIP Mod "D". We have no knowledge of ECO #1278 and will therefore have to hold this dwg. pending receipt of ECO #1278 or other description of this change. (It is recommended that MIT/IL include copies of internal ECO's when Apollo prints are revised in this manner to aid Sperry in evaluating revisions such as these.)

B. The Block II Documentation (Dwgs., Procedures, Specifications) was due on the Milestone date of January 2, 1963 but has not been received as yet.

APOLLO 16 PIP MODEL D PROGRAM (R&D)

Contract NAS 9-455

Weekly Progress Report No. 38

January 21, 1963

Prepared by

Sperry Gyroscope Company
Division of Sperry Rand Corporation
Great Neck, New York

M. R. Blumenstock

for N. R. Blumenstock
Engineering Program Director

I. INTRODUCTION

This report summarizes the Sperry activities and progress achieved under Contract NAS 9-455 during the period January 14, 1963 through January 20, 1963.

II. GENERAL ACTIVITIES

A. Unit #AP-6 is now in shroud assembly. Heater-sensor calibration proved out perfectly.

B. Unit #AP-7 will now be placed into the tank for"72 hour evacuation."

C. Unit #AP-8 T.G. Microsyn has passed incoming inspection and is now in ducosyn assembly.

D. Seventy-seven Apollo PIP Block II drawings plus a Document Control List, PIP Parts List and Accessories Parts List arrived late last Monday, January 14. This receipt occurred after last week's progress report had been mailed out. It is Sperry's understanding that this defines Block II except for ACO #3071 which was received on Friday, January 18, 1963.

E. Sperry Engineer, J. Mc Cooey, contacted R. Massarra of MIT/IL by telephone on January 18, relative to the "Open Loop" tests to be performed on Block"0" units #AP-7 and AP-8. The gist of this conversation is as follows:

1. The Apollo Final Test Console is now available for open loop tests.

2. MIT/IL will supply to Sperry on Monday, January 21, the following:

   a. Draft copy of "open loop tests" from MC1500

   b. Drawings depicting Mod D electrical connections to console (cable & connectors)

   c. Mod D Final Test Mount

3. The 1.024 mc oscillator now in the Final Test Console should be used as is for these "open loop" tests on units #AP-7 and #AP-8.

III. STATUS OF MAJOR PARTS & SUB-ASSEMBLIES

A. Status of Assembly

Unit No.	Remarks
AP-1	Delivered
AP-2	"
AP-3	"
AP-4	"
AP-5	"
AP-6	In shroud assembly
AP-7	Ready for 72 hr. evacuation
AP-8	In ducosyn assembly

B. Torque and Signal Generator Microsyn Assembly - Block "O"

	Total Compl. (todate)	Additional Parts In Process	Total Compl. (todate)	Additional Parts In Process
Stacked & Bonded P/N AP96016	12	-	11	-
Surface Grind	12	-	11	-
Mount Coils & Terminal Rings	11	-	11	-
Final Test of Micro. Assembly	11	-	11	-
Assembled into Housing	11	-	11	-
Potted, cured & cycled	11	-	11	-
Ground Assemblies	9	-	10	-
Inspection	8	-	8	-
Ducosyn Assembly	8	-	7	1
	S.G. Coil (AP93246)		T.G. Coil (AP93231)	
Inspection	96	-	80	-
Tested & Grouped	96	-	80	-

C. Torque & Signal Generator Microsyn Assembly - Block I

Stacked & Bonded IAP96016	26	-	25	-
Surface Grind	26	-	25	-
Mount Coils & Terminal Rings	17	8	4	21
Impregnation	10	3	3	1
Assembled into Housing	3	7	3	1
Potted, cured & cycled	-	3	-	3
	S.G. Coil (IAP96127)		T.G. Coil (IAP96131)	
Inspection	25	-	25	-
Tested & Grouped	25	-	25	-

D. Internal Suspension Assembly Block "O" Block "I"

Stacked, Bonded & Ground P/N AP93239	20	-	52	-
Inspection	20	-	52	-
Durafilm	20	-	21	31
Coil Winding & Term. Assembly	20	-	21	16
Final Test of I.S. Assembly	20	-	21	-
Impregnation	20	-	7	14
Assembled into Housing	20	-	7	-
Potted, Cured & Cycled	19	-	7	-
Grinding	18	-	-	7
Inspection	16	-	-	-
Ducosyn Prep.	16	-	-	-

IV. STATUS OF APOLLO CHANGE ORDERS

ACO #	Date Rec'd	Cost Incr.	Auth. Req'd.	Auth. Rec'd	Current Status of ACO	
3023	12/18	No	No	-	Released 12/19/62	
3026	10/5	(Decr.)	Yes	1/10/63	Released 9/26/62	
3027	11/23	No	No	"	" 11/26/62	
3028	"	"	"	"	" "	
3029	12/18	"	"	-	" 12/19/62	
3030	11/23	Yes	Yes	1/10/63	Superseded by ACO #3C71	
3031	12/27	No	No	-	Released 12/28/62	
3033	11/23	"	"	1/10/63	" 11/26/62	
3034	"	"	"	"	" "	
3035	"	"	"	"	" "	
3036	"	"	"	"	" "	
3037	"	"	"	"	" "	
3038	"	"	"	"	" "	
3039	"	"	"	"	" "	
3040	"	"	"	"	" "	
3041	"	"	"	"	" "	
3042	"	"	"	"	" "	
3043	12/27	TBA	Yes	-	Held for auth.	
3044	12/18	No	No	-	Released 12/19/62	
3045	11/23	"	"	1/10/63	" 11/26/62	
3046	"	"	"	"	" "	
3047	"	"	"	"	" "	
3048	"	"	"	"	" "	
3049	"	"	Yes	"	" "	
3050	"	"	No	"	" "	
3051	"	"	"	"	" "	
3052	"	"	"	"	" "	
3053	12/27	"	"	-	" 12/28/62	
3054	12/18	"	"	-	" 12/19/62	
3055	12/27	"	"	-	" 12/28/62	
3056	12/18	"	"	-	" 12/19/62	
3057	12/27	"	"	-	" 12/28/62	
3060	12/27	"	"	-	" "	
3061	12/18	"	"	-	" 12/19/62	
3062	12/27	"	"	-	" 12/28/62	
3063	"	Yes	Yes	-	Held for auth.	
3064	12/18	No	No	-	Released 12/19/62	
3065	"	Yes	Yes	-	" "	in advance of auth.
3068	"	No	No	-	" "	
3071	1/18/63	Yes	Yes	-	In Process	

V. PROBLEM AREAS

A. In reference to the Drawing Problems mentioned in last week's report:

#95921E - Held awaiting instruction from MIT/IL re missing change information
#95913E - " " " " " " "
#95904G - Held for sub letter advance to H instructions
#MA96670B Receipt of ECO #1278 from MIT/IL revealed that no problem exists. Drawing was released.
#MA96141-1A Receipt of this dwg. cleared up the problems associated with the Filling Fixture as mentioned in the weekly report of 1/7/63.

APOLLO 16 PIP MODEL D PROGRAM (R&D)

Contract NAS 9-455

Weekly Progress Report No. 39

January 28, 1963

Prepared by

Sperry Gyroscope Company
Division of Sperry Rand Corporation
Great Neck, New York

N. R. Blumenstock
Engineering Program Director

I. INTRODUCTION

This report summarizes the Sperry activities and progress achieved under Contract NAS 9-455 during the period January 21, 1963 through January 27, 1963.

II. GENERAL ACTIVITIES

A. Unit designated as #AP-6 is now in ducosyn assembly.

B. Unit designated as #AP-7 will now undergo open loop final testing.

C. Unit designated as #AP-8 is in the 72 hour pump down operation prior to filling.

D. The Block II Drawings have been released to Manufacturing. ACO #3071 was reviewed, processed by Sperry's change committee and released in advance of authorization of the cost increase. Since ACO #3071 cancelled and superseded ACO #3030, the change cost estimate form #6147 for ACO #3071 includes costs for both changes.

E. Rudy Massara of MIT/IL telephoned the Mod "D" cable connections to J. McCooey of Sperry. He also hand carried the MC1500 draft copy of the open loop tests plus a preliminary version of the final test mount to Sperry on January 24. Sperry is now proceeding with the set up of these open loop tests. The only remaining requirement is the authorization of this change in contractual test requirements via a Contracting Officer's Memo.

F. Mr. R. Hannah of Sperry arrived at American Beryllium in Sarasota, Florida to observe the critical grinding operations of Block I potted components. He was on hand to personally evaluate the grinding problem which occurred with the first group of I.S. assemblies. Refer to the "Problem Areas" of this report for details.

G. Due to the imminent start of Block "O" Final Tests and the immediate availability of the sixth unit, there will be a change in the remaining three Block "O" unit # assignments as follows:

Shop #6 - Becomes S/N AP-7 and will start Final Tests immediately
Shop #7 - Becomes S/N AP-8 and will be tested shortly
Shop #8 - Becomes S/N AP-6 and will be shipped after assembly

III. STATUS OF MAJOR PARTS & SUB-ASSEMBLIES

A. Status of Assembly

Unit No.	Remarks
AP-1	Delivered
AP-2	"
AP-3	"
AP-4	"
AP-5	"
AP-6	In ducosyn assembly
AP-7	Start Final test
AP-8	In 72 hr. evacuation

B. Torque and Signal Generator Microsyn Assembly - Block "O"

	Total Compl. (todate)	Additional Parts In Process	Total Compl. (todate)	Additional Parts In Process
Stacked & Bonded P/N AP96016	12	-	11	-
Surface Grind	12	-	11	-
Mount Coils & Terminal Rings	11	-	11	-
Final Test of Micro. Assembly	11	-	11	-
Assembled into Housing	11	-	11	-
Potted, cured & cycled	11	-	11	-
Ground Assemblies	9	-	10	-
Inspection	8	-	8	-
Ducosyn Assembly	8	-	8	-
	S.G. Coil (AP93246)		T.G. Coil (AP93231)	
Inspection	96	-	80	-
Tested & Grouped	96	-	80	-

C. Torque & Signal Generator Microsyn Assembly - Block I

Stacked & Bonded IAP96016	26	-	25	-
Surface Grind	26	-	25	-
Mount Coils & Terminal Rings	17	8	4	21
Impregnation	10	3	3	1
Assembled into Housing	7	3	3	-
Potted, cured & cycled	5	2	3	-
Ground assemblies	-	3	-	3
	S.G. Coil (IAP96127)		T.G. Coil (IAP96131)	
Inspection	25	-	25	-
Tested & Grouped	25	-	25	-

D. Internal Suspension Assembly	Block "O"		Block "I"	
Stacked, Bonded & Ground P/N AP93239	20	-	52	-
Inspection	20	-	52	-
Durafilm	20	-	21	31
Coil Winding & Term. Assembly	20	-	21	16
Final Test of I.S. Assembly	20	-	21	-
Impregnation	20	-	21	-
Assembled into Housing	20	-	21	-
Potted, cured & cycled	19	-	8	13
Grinding	18	-	7	1
Inspection	16	-	-	-
Ducosyn Prep.	16	-	-	-

V. PROBLEM AREAS

A. In reference to the Drawing Problems previously mentioned:

#95921E - Revised drawing received & released
#95913E - Revised drawing received & released
#95904H - Revised drawing received & released

B. A serious problem has been encountered during grinding operations at American Beryllium. This problem developed as follows:

1. Eight potted I.S. Assemblies, P/N IAP95912, were shipped to American Beryllium on January 18, for finish grinding.

2. Of the first seven units ground by January 24, five showed evidence of cutting into the end turns on the short side of the taper. Two were satisfactory.

3. With R. Hannah of Sperry observing, it was determined by dimensional checking with MIT/IL prints, that the I.S. Assemblies (P/N IAP 93236) were properly bottomed on the I.S. Support (P/N IAP95956).

4. An immediate "HOLD" was placed on the remaining 13 I.S. Assemblies (P/N IAP93236) not yet potted but already impregnated.

5. Examination of the 13 units ready for potting revealed they are apparently to print and very tightly machine wound.

6. The P/N 95961-1 taper gauges supplied to Sperry and American Beryllium by MIT/IL were suspected but Sperry does not have the MIT/IL taper gauge drawing.

7. There is no existing specification as to radial position of the end turns of the P/N IAP 93236 Assembly.

8. J. Morgan of Sperry telephoned G. Fairweather of MIT/IL re this problem on January 25. The location of the taper relative to the end turns was obtained in order to determine the clearances involved.

9. Block "0" potted I.S. Assemblies were ground without this interference and the only apparent difference in design is the removal of a 45° chamfer on the winding slot bores of P/N IAP 93239.

10. Ten more I.S. Assemblies P/N IAP 93236 are now available prior to impregnation.

11. The action planned to eliminate the problem is as follows:

- The required clearance from taper to coils will be calculated.
- An attempt will be made to adjust the ten I.S. Assemblies to provide this clearance
- The 13 impregnated I.S. Assemblies will be checked to determine if any will provide the necessary clearance
- All acceptable I.S. Assemblies will then be potted and sent to grinding.

- An Engineering Change Request will be submitted to MIT/IL requesting the required definition of end turn radial position on the P/N IAP 93236 I.S. Assembly drawing.

- Sperry will x-ray and/or section the damaged I.S. Assemblies to determine the degree of eccentricity built in to these units. This could be a possible source of trouble if the bore of the I.S. Assembly P/N IAP 93236 is excessively eccentric relative to the winding slot bores. A check of tolerances involved indicated a design maximum eccentricity of .006" which should not cause trouble.

12. The full impact of this problem on the scheduled delivery of unit #AP-10 and subsequent has yet to be determined.

APOLLO 16 PIP MODEL D PROGRAM (R&D)

Contract NAS 9-455

Weekly Progress Report No. 40

February 4, 1963

Prepared by

Sperry Gyroscope Company
Division of Sperry Rand Corporation
Great Neck, New York

N. R. Blumenstock
Engineering Program Director

I. INTRODUCTION

This report summarizes the Sperry activities and progress achieved under Contract NAS 9-455 during the period January 28, 1963 through February 3, 1963.

II. GENERAL ACTIVITIES

A. Unit designated last week as #AP-6 is now in final assembly. On first assembly the S.G. and I.S. concentricity appeared to be out of tolerance. After teardown and cleaning it will be reassembled and checked again.

B. Unit designated last week as #AP-7 completed the first open loop final test. Results are being analyzed now. Preliminary opinion holds that this is a good unit and that the results plus the proposed test specification should be reviewed in detail to reconcile any differences.

C. Unit designated last week as AP-8 has been x-rayed and is now in shroud installation.

D. One print each of P/N's MA95959A, MA95960B, MA95961A, MA95962, MA96069, MA96002 were received from MIT/IL on January 29.

E. In an effort to minimize the Block I "hold" due to the I.S. coil and grinding problem, Sperry has manufactured a fixture for the radial and axial positioning of I.S. coil end turns prior to impregnation and potting. The un-impregnated I.S. assemblies have now been restarted in the assembly line with the help of this fixture. The impregnated I.S. assemblies await disposition.

F. R. Hannah, N. Blumenstock & J. Morgan of Sperry attended a T.D. meeting and Change Control Board meeting for Apollo PIP at MIT/IL on Thursday and Friday.

G. Early in the Thrusday meeting, MIT/IL advised of a new change required on the P/N IAP 96014 Rotor Assembly. Although this change had not yet been defined in detail, it was deemed urgent enough to require an immediate "Hold" be placed on any unfinished rotors at the sub-contractor's plant. This was done on Thursday, January 31, and will remain in effect until MIT/IL defines the change via ACO. Thirty eight rotors for Block I have already been received under the existing configuration and will be utilized as is unless advised to the contrary by MIT/IL.

H. By late Friday, a new plan of action had been formulated at the Apollo T.D. meeting. This plan was agreed to by NASA, MIT/IL and Sperry attendees at the meeting and will be followed shortly by a Contracting Officer's Memo and an ACO. Since the contract changes are urgently required, it was agreed that Sperry would take immediate action on the following points:

"Proposed Contracting Officer's Memo"

A. Modify the quantity of 16 PIP Mod D units to be delivered under contract NAS 9-455 as follows:

1.) Reduce total quantity from seventy-two (72) to seventy (70) by eliminating two (2) of the eight (8) units (p/N 95944) constituting the block 0 deliveries.

2.) Serial numbered units AP-7 and AP-8 already built as block 0 units (P/N 95944) to be rebuilt replacing the Micresyn Housing, Potted Torque Generator P/N 95951 with Micresyn Housing Potted Torque Generator P/N 96123.

3.) On serial numbered unit AP-7 and all subsequent units rotate the rotor (P/N 96014 Rev B) forty-five (45) degrees (either direction) with respect to the float body P/N 95921 in the IA - PRA plane. Modify the procedures and tooling necessary to accomplish this. (T.G. end only)

B. Eliminate the requirement for closed loop testing on serial numbered units AP-7 thru AP-18 inclusive.

C. On Block II units (forty-five units total) modify the following parts as directed.

1.) Rotor P/N 108008 eliminate the .1875 inch wide axial slots. Place a hold on the fabrication of these parts at that operation in which the slots are made.

2.) Float Body 108002 eliminate the .1875 inch wide axial slots. Place a hold on the fabrication of these parts at that operation in which the slots are made.

3.) Damping Fluid 108054 change the density of the fluid. (Specification to follow).

4.) Balancing Fluid (Appendix A-8 to MC-1500) Change density to conform to (3) above. (Specification to follow.)

5.) Density Plumetts P/N MA-96670-12-1 and MA-96670-12-2 Change density and color. (Specifications to follow.)

6.) Ring Alignment (P/N 108047) Place a hold on the fabrication of these parts pending a change in material and geometry.

7.) Ring, Mounting (P/N 108047) Place a hold on the fabrication of these parts pending a change in material and geometry.

I. In view of the requirement to rebuild the two final tested Block "0" units above as Block "I" units, the Serial Numbers of the last three Block "0" will revert back to their original designation. Shop #6,7,and 8 becomes S/N AP-6, 7, and 8.

III. STATUS OF MAJOR PARTS & SUB-ASSEMBLIES

A. Status of Assembly

Unit No.	Remarks
AP-1	Delivered
AP-2	"
AP-3	"
AP-4	"
AP-5	"
AP-6	In final assembly
AP-7	In final test
AP-8	Inst. of shrouds

B. Torque and Signal Generator Microsyn Assemblies - Block "O"

	S.G. #AP96012		T.G. #AP96013	
	Total Completed (to date)	Additional Parts In Process	Total Completed (to date)	Additional Parts In Process
Stacked & Bonded P/N AP96016	12	-	11	-
Surface Grind	12	-	11	-
Mount Coils & Terminal Rings	11	-	11	-
Final Test of Micro. Assembly	11	-	11	-
Assembled into Housing	11	-	11	-
Potted, cured & cycled	11	-	11	-
Ground Assemblies	9	-	10	-
Inspection	8	-	8	-
Ducosyn Assembly	8	-	8	-
	S.G. Coil (AP93246)		T.G. Coil (AP93231)	
Inspection	96	-	80	-
Tested & Grouped	96	-	80	-

C. Torque & Signal Generator Microsyn Assemblies - Block "I"

	S.G. #IAP96059		T.G. #IAP 96126	
Stacked & Bonded IAP96016	26	-	25	-
Surface Grind	26	-	25	-
Mount Coils & Terminal Rings	25	1	24	1
Impregnation	17	8	9	15
Assembled into Housing	11	6	9	-
Potted, cured & cycled	5	6	5	4
Ground assemblies	-	3	-	3
Inspection				
Ducosyn Preparation				
	S.G. Coil (IAP96127)		T.G. Coil (IAP96131)	
Inspection	25	-	25	-
Tested & Grouped	25	-	25	-

D. Internal Suspension (P/N (3236)	Block "O"		Block "I"	
Stacked, Bonded & Ground P/N AP93239	20	-	52	-
Inspection	20	-	52	-
Durafilm	20	-	31	21
Coil Winding & Term. Assembly	20	-	31	-
Final Test of I.S. Assembly	20	-	31	-
Impregnation	20	-	21	10
Assembled into Housing	20	-	21	-
Potted, cured & cycled	19	-	8	13
Grinding	18	-	2	1
Inspection	16	-	-	-
Ducosyn Preparation	16	-	-	-

IV. STATUS OF APOLLO CHANGE ORDERS

ACO #	Date Rec'd	Cost Incr.	Auth. Req'd.	Auth. Rec'd	Current Status of ACO
3023	12/18	No	No	-	Released 12/19/62
3026	10/5	(Decr.)	Yes	1/10/63	Released 9/26/62
3027	11/23	No	No	"	" 11/26/62
3028	"	"	"	"	" "
3029	12/18	"	"	-	" 12/19/62
3030	11/23	Yes	Yes	1/10/63	Superseded by ACO #3071
3031	12/27	No	No	-	Released 12/28/62
3033	11/23	"	"	1/10/63	" 11/26/62
3034	"	"	"	"	" "
3035	"	"	"	"	" "
3036	"	"	"	"	" "
3037	"	"	"	"	" "
3038	"	"	"	"	" "
3039	"	"	"	"	" "
3040	"	"	"	"	" "
3041	"	"	"	"	" "
3042	"	"	"	"	" "
3043	12/27	TBA	Yes	-	Held for auth.
3044	12/18	No	No	-	Released 12/19/62
3045	11/23	"	"	1/10/63	" 11/26/62
3046	"	"	"	"	" "
3047	"	"	"	"	" "
3048	"	"	"	"	" "
3049	"	"	Yes	"	" "
3050	"	"	No	"	" "
3051	"	"	"	"	" "
3052	"	"	"	"	" "
3053	12/27	"	"	-	" 12/28/62
3054	12/18	"	"	-	" 12/19/62
3055	12/27	"	"	-	" 12/28/62
3056	12/18	"	"	-	" 12/19/62
3057	12/27	"	"	-	" 12/28/62
3060	12/27	"	"	-	" "
3061	12/18	"	"	-	" 12/19/62
3062	12/27	"	"	-	" 12/28/62
3063	"	Yes	Yes	-	Held for auth.
3064	12/18	No	No	-	Released 12/19/62
3065	"	Yes	Yes	-	" " in advance of auth.
3068	"	No	No	-	" "
3071	1/18/63	Yes	Yes	-	Released 1/21/63 in advance of auth.

V. PROBLEM AREAS

A. Re the I.S. coil abrasion during grinding:

1. Cross sections & x-ray photographsof the 5 damaged P/N IAP 95912 assemblies revealed that the interference was due solely to the placement of the end turns on the I.S. coils.

2. The 13 impregnated I.S. assemblies have been checked against the end turn wire placement tool and the necessary clearance was lacking. These assemblies cannot be used for the Apollo PIP but will be acceptable to the Polaris PIP program.

3. The remaining unimpregnated I.S. assemblies have had their end turns repositioned and are currently in process of impregnating and potting.

4. Eccentricity has not caused this problem. The cross section and x-rays verified this conclusion.

5. Sperry is now awaiting an ACO defining the desired configuration of I.S. coil end turns.

APOLLO 16 PIP MODEL D PROGRAM (R&D)

Contract NAS 9-455

Weekly Progress Report No. 41

February 11, 1963

Prepared by

Sperry Gyroscope Company
Division of Sperry Rand Corporation
Great Neck, New York

N. R. Blumenstock
Engineering Program Director

I. INTRODUCTION

This report summarizes the Sperry activities and progress achieved under Contract NAS 9-455 during the period February 4, 1963 through February 10, 1963.

II. GENERAL ACTIVITIES

A. Unit redesignated last week as AP-6 was delivered to MIT/IL on Thursday, Feb.7.

B. Unitsredesignated last week as AP-7 & AP-8 were started on tear-down in accordance with MIT/IL instructions to prepare for design changes. See Problem Areas.

C. Pending receipt of MIT/IL Apollo Change Orders defining new configurations, the following Block II parts are now on "HOLD" status:

P/N 108002	Float Body
108008	Rotor
108047	Alignment Ring
108048	Mounting Ring
108054	Damping Fluid
(-)	Balancing Fluid

D. Mr. J. Morgan of Sperry hand carried potted microsyns assemblies to American Beryllium for grinding on Tuesday to expedite operations. In addition, he reviewed quality control and manufacturing techniques at American Beryllium in connection with discrepancies found by Sperry on ground microsyns, mounting and alignment rings, float bodies & main housings. Most of the problems involve measurement techniques and sporadic quality of delivered parts. American Beryllium will visit Sperry this week in an effort to thrash out the differences between Sperry Incoming Inspection measurement techniques vs. their own techniques.

III. STATUS OF MAJOR PARTS & SUB-ASSEMBLIES

A. Status of Assembly

Unit No.	Remarks
AP-1	Delivered
AP-2	"
AP-3	"
AP-4	"
AP-5	"
AP-6	"
AP-7	In teardown
AP-8	In teardown

B. Torque and Signal Generator Microsyn Assemblies - Block "O"

	S.G. #AP96012		T.G. #AP96013	
	Total Completed (to date)	Additional Parts in Process	Total Completed (to date)	Additional Parts in Process
Stacked & Bonded P/N AP96016	12	-	11	-
Surface Grind	12	-	11	-
Mount Coils & Terminal Rings	11	-	11	-
Final Test of Micro. Assembly	11	-	11	-
Assembled into Housing	11	-	11	-
Potted, Cured & Cycled	11	-	11	-
Ground Assemblies	9	-	10	-
Inspection	8	-	8	-
Ducosyn Assembly	8	-	8	-
	S.G. Coil (AP93246)		T.G. Coil (AP93231)	
Inspection	96	-	80	-
Tested & Grouped	96	-	80	-

C. Torque & Signal Generator Microsyn Assemblies - Block "I"

	S.G. #IAP96059		T.G. #IAP 96126	
Stacked & Bonded IAP96016	26	-	25	-
Surface Grind	26	-	25	-
Mount Coils & Terminal Rings	25	1	24	1
Impregnation	24	-	24	-
Assembled into Housing	19	5	19	5
Potted, cured & cycled	5	6	-	6
Ground assemblies	2	2	3	-
Inspection	2	-	3	-
Ducosyn Preparation	-	2	-	2
	S.G. Coil (IAP96127)		T.G. Coil (IAP96131)	
Inspection	25	-	25	-
Tested & Grouped	25	-	25	-

D. Internal Suspension (P/N (3236)	Block "O"		Block "I"	
Stacked, Bonded & Ground P/N AP93239	20	-	39	-
Inspection	20	-	39	-
Durafilm	20	-	35	4
Coil Winding & Terminal Assembly	20	-	35	-
Final Test of I.S. Assembly	20	-	35	-
Impregnation	20	-	32	3
Assembled into Housing	20	-	19	13
Potted, Cured & Cycled	19	-	17	-
Grinding	18	-	3	-
Inspection	16	-	3	-
Ducosyn Preparation	16	-	-	2

IV. STATUS OF APOLLO CHANGE ORDERS

Same as last week

V. PROBLEM AREAS

A. Sperry is now awaiting an ACO defining the desired configuration of I.S. coil end turns.

B. Sperry has started the tear down of units S/N AP-7 and AP-8 in advance of autherization in accordance with verbal instructions received from MIT/IL. We are awaiting an ACOdefining the teardown, rebuilding with Block I Torquers, and the definition of the Final Tests to be performed on these two Block "0" units.

C. Sperry is awaiting ACO's to retate the roters on all Block "I" units S/N AP-9 thru AP-27 and to redefine Final Test requirements for Block "I" units S/N AP-9 thru AP-18 .

D. Sperry is also awaiting ACO's defining the desired changes to Block II. In the meantime, manufacture of the affected parts has stopped.

NOTE: Three "Contracting Officer's Memos" have been received. These letters serve to formalize the changes outlined by MIT/IL at the previous T.D. Meeting. ACO's are still anticipated, however, to spell out all details of the changes involved.

APOLLO 16 PIP MODEL D PROGRAM (R&D)

Contract NAS 9-455

Weekly Progress Report No. 42

February 18, 1963

Prepared by

Sperry Gyroscope Company
Division of Sperry Rand Corporation
Great Neck, New York

N. R. Blumenstock
Engineering Program Director

I. INTRODUCTION

This report summarizes the Sperry activities and progress achieved under Contract Nas 9-455 during the period February 11, 1963 through February 18, 1963.

II. GENERAL ACTIVITIES

A. The two Block "0" units were reworked into Block I configuration as S/N AP-9 & AP-10. Both were placed into the Filling Tank for pump down & 72 hr. evacuation.

B. Pending receipt of MIT/IL Apollo Change Orders defining new configurations, the following Block II parts are on "HOLD" status:

P/N 108002 Float Body	P/N 108008 Rotor
108047 Alignment Ring	108048 Mounting Ring
108054 Damping Fluid	(-) Balancing Fluid

C. Messrs. T. Williams and R. Murray of American Beryllium Corp. visited Sperry on Wednesday, February 13, to resolve recent quality control problems. The following was agreed upon:

1. P/N (IAP) 95906 Mount Rings and P/N (IAP) 95905 Alignment Rings returned to American Beryllium last week for exceeding flatness requirements were reworked by polishing to permit optical flat measurements. These parts will now be reinspected by Sperry. Polishing will now be standard on all future shipments.

2. P/N (IAP) 95904F Main Housings with tapered 1.4000/1.4001 diameter were reworked satisfactorily and returned to Sperry. The .000050" squareness requirement is being changed by MIT/IL to .0005".

3. P/N (IAP) 95912 Internal Suspensions having raised projections in the jewel cavities should no longer be a problem. MIT/IL has given permission to American Beryllium to remove the material by drilling.

4. The two P/N (IAP) 96145 and (IAP) 96123 Microsyn Housings rejected due to roundness and stepped radii have now been scrapped. American Beryllium advised the cause was an inoperative idler pulley on their internal grinder which has since been corrected. The two scrapped microsyn housings were given to American Beryllium in order to permit them to fabricate new holding fixtures.

5. P/N (IAP) 95921D Float Bodies rejected for tear marks will have a deburring operation added prior to reaming to permit withdrawal of the tool without damaging the parts. Also, the anticipated Block II change from MIT/IL which removes the .1875 - .1880 slots should eliminate the rejections for irregular burring.

6. Radius discrepancies on P/N (IAP) 95912, (IAP) 95951, (IAP 95952 will be eliminated by adding a lathe operation to American Beryllium's manufacturing procedure. An Indi-Ron, new on order by American Beryllium should also permit closer correlation in roundness and concentricity measurements.

III. STATUS OF MAJOR PARTS & SUB-ASSEMBLIES

A. Torque and Signal Generator Microsyn Assemblies - Block "O"

	S.G. #AP96012		T.G.# AP96013	
	Total Completed (to date)	Additional Parts in Process	Total Completed (to date)	Additional Parts in Process
Stacked & Bonded P/N AP96016	10	-	11	-
Surface Grind	10	-	11	-
Mount Coils & Terminal	9	-	11	-
Final Test of Micro. Assembly	9	-	11	-
Assembled into Housing	9	-	11	-
Potted, Cured & Cycled	9	-	11	-
Ground Assemblies	7	-	10	-
Inspection	6	-	8	-
Ducosyn Assembly	6	-	8	-
	S.G. Coil (AP93246)		T.G. Coil (AP93231)	
Inspection	72	-	60	-
Tested & Grouped	72	-	60	-

B. Torque & Signal Generator Microsyn Assemblies - Block "I"

	S.G. #IAP96059		T.G. #IAP96126	
Stacked & Bonded IAP96016	28	-	25	-
Surface Grind	28	-	25	-
Mount Coils & Terminal Rings	27	1	24	1
Impregnation	26	-	24	-
Assembled into Housing	21	1	24	-
Potted, cured & cycled	20	1	18	5
Ground Assemblies	7	6	4	6
Inspection	4	2	3	-
Ducosyn Preparation	3	1	2	1
	S.G. Coil (IAP96127)		T.G. Coil (IAP96131)	
Inspection	25	-	25	-
Tested & Grouped	25	-	25	-

C. Inertial Suspension (P/N (3236)

	Block "O"		Block "I"	
Stacked, Bonded & Ground P/N AP93239	16	-	54	-
Inspection	16	-	54	-
Durafil	16	-	54	-
Coil Winding & Terminal Assembly	16	-	54	-
Final Test of I.S. Assembly	16	-	54	-
Impregnation	16	-	54	-
Assembled into Housing	16	-	54	-
Potted, cured & cycled	15	-	38	4
Grinding	14	-	12	-
Inspection	12	-	7	-
Ducosy Preparation	12	-	5	2

D. Status of Assembly

Unit No.	Remarks
AP-1	Delivered
AP-2	"
AP-3	"
AP-4	"
AP-5	"
AP-6	"
AP-9	In 72 hr. evacuation
AP-10	In 72 hr. evacuation

IV. STATUS OF APOLLO CHANGE ORDERS

Same as February 4, 1963

V. PROBLEM AREAS

1. Sperry is awaiting ACO's for the following:

   A. Definition of the desired configuration for I.S. coil end turns in Blocks I & II.

   B. Sperry has completed the tear down of Block "O" units S/N AP-7 and AP-8 and is rebuilding them as Block I units S/N AP-9 and AP-10. Sperry is now awaiting a Block "O" ACO defining the teardown and rebuilding of these units.plus the definition of the Final Tests to be performed on these two units.

   C. Rotation of the rotors on all Block "I" units S/N AP-9 thru AP-27 and to redefine Final Test requirements for Block "I" units S/N AP-9 thru AP-18.

   D. Definition of the desired changes to Block II. In the meantime, manufacture of the affected parts has stopped.

2. Danco Tool and Mold has advised (telecon on Friday) that Alfenol laminations for Apollo Internal Suspension Stator Cores were received back from Eastern Heat Treat contaminated with a substance that prevents stacking of the cores. They have tried cleaning in accordance with existing specifications but with no improvement. All 2000 laminations for this current order are affected. If a suitable cleaning method (one that won't damage the oxide coating) can't be found, then it will take approximately two weeks to replace these laminations and deliveries of needed I.S. cores will be similarly affected. Danco will investigate further and advise progress.

APOLLO 16 PIP MODEL D PROGRAM (R&D)

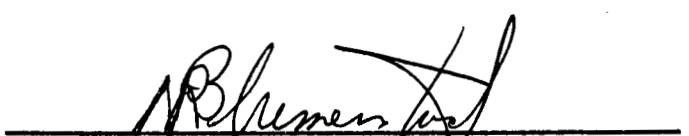
Contract NAS 9-455

Weekly Progress Report No. 43

February 25, 1963

Prepared By

SPERRY GYROSCOPE COMPANY
Division of Sperry Rand Corporation
Great Neck, New York



N. R. Blumenstock
Engineering Program Director

I. INTRODUCTION

This report summarizes the Sperry activities and progress achieved under Contract Nas 9-455 during the period February 18, 1963 through February 25, 1963.

A. Unit #IAP-9 completed Final Alignment and is now in Heater Sensor calibration.

B. Unit #IAP-10 was pushed together on Thursday and is now in Final Alignment.

C. Unit #IAP-11 is now in Final Assembly.

D. Three (3) work copies of MC-1500 Assembly & Test Manual were received from MIT/IL on Tuesday, February 19th. This document is now under review by Engineering, Quality Assurance (for Test & Inspection), Methods and Manufacturing. Sperry plans to complete the review by Monday, February 25th and to discuss the results with MIT/IL at the forthcoming C.C.B. meeting.

E. Sperry advised MIT/IL, per telecon February 18th between J. Morgan and E. Fairweather, that the hold on the Block II parts was placed with the understanding that details of the change would be forthcoming shortly and that any further delay would begin to affect Block II schedules. The earliest MIT/IL anticipated release of details was to be at the next C.C.B. meeting tentatively scheduled for the week of February 25th.

F. Review of the three Contracting Officer's Memos which outlined the basic contract changes revealed that all three were expected to result in cost decreases. The two letters concerning reduction in work scope undoubtedly will result in cost reduction but the third, which placed a hold on certain Block II parts pending definition of design changes, will apparently result in schedule delay and attendant cost increase.

Since, in accordance with clause 2, all changes resulting in schedule delay and cost increase are to be authorized by NASA prior to their incorporation into the product, Sperry had no choice but to consider release of the "Hold" to prevent further expense and delay. NASA had previously advised that Contracting Officer's Memos could not authorize cost increases or schedule delays.

According, Mr. J. Morgan called Mr. J. Barnard (NASA at MIT/IL) on Tuesday, February 19th to advise him of Sperry's position and to obtain NASA's recommended course of action. The last release dates for Sperry's on time purchase of the Block II parts affected, occurred between January 21st

and January 28th. The "Hold" was placed into effect on February 1st. Mr. Barnard agreed that either an authorized TWX or written Technical Directive would be necessary to authorize continuance of the "Hold" and the accumulation of additional cost and schedule delay. He also agreed to advise MIT/IL.

G. J. Morgan to E. Fairweather telecon of February 20th advised of the latest development and of the imminent release of the "Hold".

H. After a final telecon, J. Morgan to J. Barnard on February 21st, the "Hold" was released by Sperry on all affected Block II parts at noon of the same day. This release authorized Sperry's subcontractors to resume manufacture in accordance with the existing design.

I. At 3:00 P.M. on February 21st, an MIT/IL TWX was received which released change details on Float Bodies, Rotors, Fluids & Density Floats. The "Hold" was continued on Alignment & Mounting Rings. Float assembly instructions were also given. MIT/IL advised they could supply density floats and Block I type float bodies, rotors, alignment rings, and mount rings if the late release of Block II parts would cause a schedule delay.

J. Sperry prepared Emergency Change Orders (ECO's) late Thursday to execute the desired changes to the affected Block II parts as defined in the TWX. These ECO's will be released Monday morning. In addition, a Quotation Estimate is being prepared to evaluate the impact of these changes on both manufacturing cost and contract scheduled deliveries.

III. A. Status of Assembly

Unit No.	Remarks
AP-1	Delivered
AP-2	"
AP-3	"
AP-4	"
AP-5	"
AP-6	"
IAP-9	Heater sensor Calibration
IAP-10	In Final Alignment
IAP-11	In Final Assembly

B. Torque and Signal Generator Microsyn Assemblies - Block "0"

	S.G. #AP96012		T.G. #AP96013	
	Total Completed (to date)	Additional Parts in Process	Total Completed (to date)	Additional Parts in Process
Stacked & Bonded P/N AP96016	10	-	11	-
Surface Grind	10	-	11	-
Mount Coils & Terminal	9	-	11	-
Final Test of Micro. Assembly	9	-	11	-
Assembled into Housing	9	-	11	-
Potted, Cured & Cycled	9	-	11	-
Ground Assemblies	7	-	10	-
Inspection	6	-	8	-
Ducosyn Assembly	6	-	8	-
	S.G. Coil (AP93246)		T.G. Coil (AP93231)	
Inspection	72	-	60	-
Tested & Grouped	72	-	60	-

C. Torque & Signal Generator Microsyn Assemblies - Block "I"

	S.G. #IAP96059		T.G. #IAP96126	
Stacked & Bonded IAP96016	28	-	25	-
Surface Grind	28	-	25	-
Mount Coils & Terminal Rings	28	1	24	1
Impregnation	28	-	24	-
Assembled into Housing	21	1	24	-
Potted, Cured & cycled	21	1	24	-
Ground Assemblies	7	6	4	6
Inspection	4	2	3	-
Ducosyn Preparation	3	1	3	-
	S.G. Coil (IAP96127)		T.G. Coil (IAP96131)	
Inspection	25	-	25	-
Tested & Grouped	25	-	25	-

D. Internal Suspension (P/N 93236) Block "0" Block "I"

Stacked, Bonded & Ground P/N AP93239	16	-	54	-
Inspection	16	-	54	-
Durafilm	16	-	54	-
Coil Winding & Terminal Ass'y	16	-	54	-
Final Test of I.S. Assembly	16	-	54	-
Impregnation	16	-	54	-
Assembled into Housing	16	-	54	-
Potted, cured & cycled	15	-	38	4
Grinding	14	-	12	23
Inspection	12	-	7	-
Ducosyn Preparation	12	-	6	1

IV. STATUS OF APOLLO CHANGE ORDERS

Same as February 4, 1963

V. PROBLEM AREAS

A. Sperry is awaiting ACO's for the following:

1. Definition of the desired configuration for I.S. coil end turns in Blocks I & II.

2. Sperry has completed the tear down of Block "0" units S/N AP-7 and AP-8 and is rebuilding them as Block I units S/N AP-9 and AP-10. Sperry is now awaiting a Block "0" ACO defining the teardown and rebuilding of these units plus the definition of the Final Tests to be performed on these two units.

3. Rotation of the rotors on all Block "I" units S/N AP-9 thru AP-27 and to redefine Final Test requirements for Block "I" units S/N AP-9 thru AP-18.

4. Definition of the desired changes to Block II in accordance with TWX #TT623243 dated 21 Febraury 1963.

B. The Density Float changes called out in TWX #TT623243 assigned color blue to the new MA96670-12-5 and color green to the new MA96670-12-6. These colors have already been used for -1 and -2 on the same drawing.

C. In the event that the "Hold" on the Block II parts does result in a forecast of schedule delay, MIT/IL has agreed to furnish Block I type parts. If this does occur, the Break-In point for the Block II design changes will have to be modified to agree with actual fact. The ACO's should take this into account.

D. Further investigation of the Alfenol I.S. Lamination problem including a telecon (J. Morgan to L. Eichinger of MIT/IL) resulted in the decision to scrap out the contaminated laminations. The problem has now been turned over to Sperry's Quality Assurance Dept. to insure that these instructions are carried out at Danco. Replacement of the Alfenol material at this time will affect Danco's schedule delivery of I.S. stator cores by at least 2 weeks. This may also have an effect on Sperry's scheduling for the I.S. assembly.

E. No tolerances have been given on the alignment and orientation of the S.G. and T.G. rotors after rotating 45 degrees as per TWX #TT623243. Sperry's Methods and Tooling Engineering group has stated they must have rotor alignment tolerances

for the preparation of an alignment fixture. This change will, of necessity, be held pending receipt of tolerance information. It should be noted here that alignment of other rotors was accomplished with the use of an MIT/IL supplied fixture and that the Manufacturing Drawings do not specify assembly tolerances. In addition, the slots were used to orient the rotors with a Sperry fixture, however, the slots have now been removed.

NOTE: In view of the problems associated with assembly of float (concentricity, angular orientation, angular alignment, squareness) now amplified by the Block II changes, it appears that a T.D. meeting should be scheduled as soon as possible.

APOLLO 16 PIP MODEL D PROGRAM (R&D)

Contract NAS 9-455

Weekly Progress Report No. 44

March 3, 1963

Prepared by

SPERRY GYROSCOPE COMPANY
Division of Sperry Rand Corporation
Great Neck, New York

for N. R. Blumenstock
Engineering Program Director

I. INTRODUCTION

This report summarizes the Sperry activities and progress achieved under Contract NAS 9-455 during the period February 25, 1963 through March 3, 1963.

II. GENERAL ACTIVITIES

A. Unit #IAP-9 completed open loop Final Tests and is now awaiting shipment.

B. Unit #IAP-10 completed final alignment and is now awaiting final tests.

C. Unit #IAP-11 is now in "72 Hour Evacuation.

D. John Morgan & C. Willette visited MIT/IL on Thursday and Friday to attend an Apollo PIP Change Control Board Meeting.

III. STATUS OF MAJOR PARTS AND SUB-ASSEMBLIES

A. Status of Assembly

Unit No.	Remarks
AP-1	Delivered
AP-2	"
AP-3	"
AP-4	"
AP-5	"
AP-6	"
IAP-9	Awaiting delivery
IAP-10	In final test
IAP-11	In 72 hour evacuation

B. Torque and Signal Generator Microsyn Assemblies - Block "O"

	S.G. #AP96012		T.G. #AP96013	
	Total Completed (to date)	Additional Parts in Process	Total Completed (to date)	Additional Parts in Process
Stacked & Bonded P/N AP96016	10	-	11	-
Surface Grind	10	-	11	-
Mount Coils & Terminal	9	-	11	-
Final Test of Micro. Assembly	9	-	11	-
Assembled into Housing	9	-	11	-
Potted, Cured & Cycled	9	-	11	-
Ground Assemblies	7	-	10	-
Inspection	6	-	8	-
Ducosyn Assembly	6	-	8	-
	S.G. Coil (AP93246)		T.G. Coil (AP93231)	
Inspection	72	-	60	-
Tested & Grouped	72	-	60	-

C. Torque & Signal Generator Microsyn Assemblies - Block "I"

	S.G. #IAP96059		T.G. #IAP96126	
Stacked & Bonded IAP96016	28	-	25	-
Surface Grind	28	-	25	-
Mount Coils & Terminal Rings	28	1	24	1
Impregnation	28	-	24	-
Assembled into Housing	21	-	24	-
Potted, Cured & Cycled	21	-	23	-
Ground Assemblies	7	9	4	13
Inspection	5	2	3	-
Ducosyn Preparation	3	2	3	-
	S.G. Coil (IAP96127)		T.G. Coil (IAP96131)	
Inspection	25	-	25	-
Tested & Grouped	25	-	25	-

D. Internal Suspension (P/N 93236)	Block "O"		Block "I"	
Stacked, Bonded & Ground P/N AP93239	16	-	54	-
Inspection	16	-	54	-
Durafilm	16	-	54	-
Coil Winding & Terminal Assembly	16	-	54	-
Final Test of I.S. Asssmbly	16	-	54	-
Impregnation	16	-	54	-
Assembled into Housing	16	-	54	-
Potted, cured & cycled	15	-	39	4
Grinding	14	-	12	23
Inspection	12	-	7	-
Ducosyn Preparation	12	-	6	1

IV. STATUS OF APOLLO CHANGE ORDERS

Same as February 4, 1963

V. PROBLEM AREAS

A. The P/N 95907 magnetic shroud for unit #AP-10 appeared to be too tight a fit over the P/N 95926 Spacer. After rework, another (slightly larger) shroud was selected to complete the assembly. It is recommended that MIT/IL consider loosening the line to line fit of the shroud on the spacer by .002". This could be added to the shroud I.D. to ease the tight fit over the wiring.

APOLLO 16 PIP MODEL D PROGRAM (R&D)

Contract NAS 9-455

Weekly Progress Report No. 45

March 10, 1963

Prepared by

SPERRY GYROSCOPE COMPANY
Division of Sperry Rand Corporation
Great Neck, New York

N. R. Blumenstock
Engineering Program Director

I. INTRODUCTION

This report summarizes the Sperry activities and progress achieved under Contract NAS 9-455 during the period March 3, 1963 through March 10, 1963.

II. GENERAL ACTIVITIES

A. Unit #IAP-9 was delivered to MIT/IL on Monday, March 3.

B. Unit #IAP-10 was delivered to MIT/IL on Thursday, March 6.

C. Unit #IAP-11 completed installation of the magnetic shield and is now entering Final Test.

D. John Morgan visited MIT/IL on Wednesday and Thursday to attend an Apollo PIP Change Control Board Meeting where 45 ACO's were approved by the CCB and presented to Sperry. These are:

3072	3087	3103
3073	3088	3104
3074	3089	3105
3075	3090	3108
3076	3091	3109
3077	3092	3111
3078	3093	3112
3079	3094	3113
3080	3095	3114
3081	3096	3115
3082	3098	3116
3083	3099	3117
3084	3100	3118
3085	3101	3119
3086	3102	3120

III. STATUS OF MAJOR PARTS AND SUB-ASSEMBLIES

A. Status of Assembly

Unit No.	Remarks
AP-1	Delivered
AP-2	"
AP-3	"
AP-4	"
AP-5	"
AP-6	"
IAP-9	"
IAP-10	"
IAP-11	In final test

B. Torque and Signal Generator Microsyn Assemblies - Block "O"

	S.G. #AP96012		T.G. #AP96013	
	Total Completed (to date)	Additional Parts in Process	Total Completed (to date)	Additional Parts in Process
Stacked & Bonded P/N AP96016	10	-	11	-
Surface Grind	10	-	11	-
Mount Coils & Terminal	9	-	11	-
Final Test of Micro. Assembly	9	-	11	-
Assembled into Housing	9	-	11	-
Potted, Cured & Cycled	9	-	11	-
Ground Assemblies	7	-	10	-
Inspection	6	-	8	-
Ducosyn Assembly	6	-	8	-
	S.G. Coil (AP93246)		T.G. Coil (AP93231)	
Inspection	72	-	60	-
Tested & Grouped	72	-	60	-

C. Torque & Signal Generator Microsyn Assemblies - Block "I"

	S.G. #IAP96059		T.G. #IAP96126	
Stacked & Bonded IAP96016	28	-	25	-
Surface Grind	28	-	25	-
Mount Coils & Terminal Rings	28	1	24	1
Impregnation	28	-	24	-
Assembled into Housing	21	-	24	-
Potted, Cured & Cycled	21	-	23	-
Ground Assemblies	13	5	9	14
Inspection	7	4	3	5
Ducosyn Preparation	3	4	3	-
	S.G. Coil (IAP96127)		T.G. Coil (IAP96131)	
Inspection	25	-	25	-
Tested & Grouped	25	-	25	-

D. Internal Suspension (P/N 93236)	Block "O"		Block "I"	
Stacked, Bonded & Ground P/N AP93239	16	-	54	-
Inspection	16	-	54	-
Durafilm	16	-	54	-
Coil Winding & Terminal Assembly	16	-	54	-
Final Test of I.S. Assembly	16	-	54	-
Impregnation	16	-	54	-
Assembled into Housing	16	-	54	-
Potted, Cured & Cycled	15	-	42	1
Grinding	14	-	12	23
Inspection	12	-	7	-
Ducosyn Preparation	12	-	6	1

IV. STATUS OF APOLLO CHANGE ORDERS

Same as February 4, 1963

V. PROBLEM AREAS

A. S/N IAP-11 exhibited a radial centering ratio that was 200% of spec requirements. This apparently resulted from the previously reported concentricity tolerance build-up problem. (See previous Weekly Progress Reports, ECR #A-45 and Minutes of CCB March 1 meeting) MIT/IL was previously contacted relative to an out of spec. concentricity condition found in this unit. A waiver was obtained since the problem arose due to tolerance build up.

MIT/IL took the concentricity problem under advisement and recommended that out of spec tolerance build up cases be examined as they occur.

The radial centering ratio problem of unit S/N IAP-11 was referred to MIT/IL, Mr. R. Massaro, who gave Sperry a telecon waiver on this condition and instructed Sperry to proceed with Final Tests of the unit. A confirming TWX was requested.

It is recommended that MIT/IL review the jewel-pivot-rotor-float concentricity tolerance and related radial centering ratio problems to determine whether changes can be made to eliminate or minimize these problems.

APOLLO 16 PIP MODEL D PROGRAM (R&D)

Contract NAS 9-455

Weekly Progress Report No. 46

March 18, 1963

Prepared by

SPERRY GYROSCOPE COMPANY
Division of Sperry Rand Corporation
Great Neck, New York

N. R. Blumenstock
Engineering Program Director

I. INTRODUCTION

This report summarizes the Sperry activities and progress achieved under Contract NAS 9-455 during the period March 11, 1963 through March 17, 1963.

II. GENERAL ACTIVITIES

A. Unit #IAP-11 completed Final Test and was delivered to MIT/IL on Friday, March 15.

B. The Sperry Apollo PIP Change Committee reviewed all of the 45 ACO's. Twenty six were released immediately as "no cost increase" changes. The remaining ACO's were held temporarily for budgetary estimates of cost and will be released shortly in advance of authorization. Half of these involve subcontractors who must be contacted to determine whether costs have been affected. A listing of the ACO's appears under Section IV of this report.

C. ACO #3097 was received from MIT/IL for preparation of a budgetary estimate. This change adds a Suspension Capacitor Assembly to Apollo PIP Block II units. The budgetary estimate required quotes from a vendor in California plus other inputs and was completed on Wednesday. A TWX was sent to M. Holzman of NASA advising the budgetary estimate of cost and the conditions on which it was based for installation in Block II. Sperry will await NASA authorization for the expenditure of existing Apollo PIP funds to accomplish ACO #3097 in advance of a formal contract change.

D. Mr. N. Martin of MIT/IL visited Sperry on Thrusday and Friday for the purpose of reviewing Sperry's comments on and recommendations for the proof copy of the proposed MC1500 Assembly and Test Manual.

III. STATUS OF MAJOR PARTS AND SUB-ASSEMBLIES

A. Status of Assembly

Unit No.	Remarks
AP-1	Delivered
AP-2	"
AP-3	"
AP-4	"
AP-5	"
AP-6	"
AP-7	Converted to IAP-9
AP-8	Converted to IAP-10
IAP-9	Delivered
IAP-10	"
IAP-11	"

IV. STATUS OF APOLLO CHANGE ORDERS

ACO#	Date Rec'd	Cost Incr.	Auth Read.	Auth Rec'd	Current Status of ACO
3063	12/27/62	Yes	Yes	No	Released in advance of auth.
3064	12/18/62	No	No	-	Released 12/19/62
3065	"	Yes	Yes	No	Released in advance of auth.
3068	"	No	No	-	Released 12/19/63
3071	1/18/63	Yes	Yes	No	Released 1/21/63 in advance of auth.
3072	3/8/63	No	No	-	Released 3/12/63
3073	"	Yes	Yes	No	Released 3/12/63 in advance of auth.
3074	"	Yes	Yes	No	Released 3/14/63 in advance of auth.
3075	"	Yes	Yes	No	Released 3/12/63 in advance of auth.
3076	"	TBA	TBA	-	Released 3/12/63 in advance of auth.
3077	"	No*	No	-	Released 3/12/63
3078	"	Yes	Yes	No	Released 3/12/63 in advance of auth.
3079	"	Yes	Yes	No	Released 3/12/63 in advance of auth.
3080	"	No*	No	-	Released 3/12/63
3081	"	TBA	TBA	-	Released 3/15/63
3082	"	No	No	-	Released 3/12/63
3083	"	TBA	TBA	-	Released 3/15/63
3084	"	TBA	TBA	-	Released 3/15/63
3085	"	TBA	TBA	-	Released 3/15/63
3086	"	No	No	-	Released 3/12/63
3087	"	No	No	-	Released 3/12/63
3088	"	No	No	-	Released 3/12/63
3089	"	No	No	-	Released 3/12/63
3090	"	No	No	-	Released 3/12/63
3091	"	No	No	-	Released 3/12/63
3092	"	No	No	-	Released 3/15/63
3093	"	Yes	Yes	No	Held pending Q.E. investigation
3094	"	TBA	TBA	-	Released 3/15/63
3095	"	TBA	TBA	-	Released 3/15/63
3096	"	Yes	Yes	No	Released 3/15/63 in advance of auth.
3097	"	Yes	Yes	No	Released 3/15/63 in advance of auth.
3098	"	Yes	Yes	No	Released 3/15/63 in advance of auth.
3099	"	Yes	Yes	No	Held pending Q.E. investigation
3100	"	Yes	Yes	No	Released 3/12/63 in advance of auth.
3101	"	Yes	Yes	No	Released 3/12/63 in advance of auth.
3102	"	Yes	Yes	No	Released 3/12/63 in advance of auth.
3103	"	Yes	Yes	No	Released 3/12/63 in advance of auth.
3104	"	Yes	Yes	No	Released 3/12/63 in advance of auth.
3105	"	Yes	Yes	No	Released 3/12/63 in advance of auth.
3108	"	No	No	-	Released 3/12/63
3109	"	No	No	-	Released 3/12/63
3111	"	Yes	Yes	No	Released 3/14/63 in advance of auth.
3112	"	Decr.	Yes	No	Released in Feb. per TWX
3113	"	No	No	-	Released 3/12/63
3114	"	No	No	-	Released 3/12/63
3115	"	Yes	Yes	No	Released 3/15/63 in advance of auth.
3116	"	Yes	Yes	No	Released 3/15/63 in advance of auth.
3117	"	Yes	Yes	No	Released 3/15/63 in advance of auth.
3118	"	Yes	Yes	No	Released 3/15/63 in advance of auth.
3119	"	No**	No	-	Released 3/12/63
3120	"	No**	No	-	Released 3/12/63

* No cost if MIT/IL supplies Density Floats by 4/1/63.
** No cost if parts supplied by MIT/IL for Block I.

V. PROBLEM AREAS

A. In order to expedite the incorporation of certain ACO's, MIT/IL has been contacted and has agreed to provide Sperry with the following parts:

Qty.	P/N	Description
20	96014	Rotor
10	96015	Connector Wire Retainer
18	96106	End Cover, Insulating
18	96102	Identification Label, NASA
3 sets	MA96670-12	Density Floats (Block II)

NOTE: There is an urgent need for these parts (except for the floats).

APOLLO 16 PIP MODEL D PROGRAM (R&D)

Contract NAS 9-455

Weekly Progress Report No. 47

March 25, 1963

Prepared by

SPERRY GYROSCOPE COMPANY
Division of Sperry Rand Corporation
Great Neck, New York

N. R. Blumenstock
Engineering Program Director

I. INTRODUCTION

This report summarizes the Sperry activities and progress achieved under Contract NAS 9-455 during the period March 18, 1963 through March 24, 1963.

II. GENERAL ACTIVITIES

A. Unit #IAP-11 completed Final Test and was delivered to MIT/IL on Friday, March 15.

B. The Sperry Apollo PIP Change Committee previously reviewed all of the 46 ACO's received from MIT/IL on 3/8/63. The remaining ACO's were held temporarily for budgetary estimates of cost and were released this week in advance of authorization. A listing of the ACO's appears under Section IV of this report.

C. Messrs: R. Hannah, N. Blumenstock, and J. Morgan of Sperry attended an Apollo PIP T.D. Meeting on Friday, March 22. One purpose of this meeting was to review the status of all changes to date. Results and highlights of the meeting will be included in the attachedment.

III. STATUS OF MAJOR PARTS AND SUB-ASSEMBLIES

A. Status of Assembly

Unit No.	Remarks
AP-1	Delivered
AP-2	"
AP-3	"
AP-4	"
AP-5	"
AP-6	"
AP-7	Converted to IAP-9
AP-8	Converted to IAP-10
IAP-9	Delivered
IAP-10	"
IAP-11	"

B. Torque and Signal Generator Microsyn Assemblies - Block "I"

	S.G. #IAP96059		T.G. #IAP96126	
	Total Completed (to date)	Additional Parts in Process	Total Completed (to date)	Additional Parts in Process
Stacked & Bonded IAP96016	28	-	24	-
Surface Grind	28	-	24	-
Mount Coils & Terminal Rings	28	-	24	-
Impregnation	28	-	24	-
Assembled into Housing	21	-	24	-
Potted, Cured & Cycled	21	-	23	-
Ground Assemblies	13	6	9	14
Inspection	13	-	3	5
Ducosyn Preparation	3	8	3	-
	S.G. Coil (IAP96127)		T.G. Coil (IAP96131)	
Inspection	25	-	25	-
Tested & Grouped	25	-	25	-

C. Torque and Signal Generator Microsyn Assemblies - Block "II"

	S.G. #IIAP108013		T.G. #IIAP108031	
Stacked & Bonded	-	-	-	-
Surface Grind	-	-	-	-
Mount Coils & Terminal Rings	-	-	-	-
Impregnation	-	-	-	-
Assembled into Housing	-	-	-	-
Potted, Cured & Cycled	-	-	-	-
Ground Assemblies	-	-	-	-
Inspection	-	-	-	-
Ducosyn Preparation	-	-	-	-
	S.G. Coil (#IIAP108016)		T.G. Coil (#IIAP108033)	
Inspection	-	-	-	-
Tested & Grouped	-	-	-	-

D. Internal Suspension	Block "I" (IAP93236)		Block "II" (IIAP108021)	
Stacked, Bonded & Ground	54	-	-	-
Inspection	54	-	-	-
Durafilm	54	-	-	-
Coil Winding & Terminal Assembly	54	-	-	-
Final Test of I.S. Assembly	42	-	-	-
Impregnation	42	-	-	-
Assembled into Housing	42	-	-	-
Potted, Cured & Cycled	38	-	-	-
Grinding	23	10	-	-
Inspection	15	8	-	-
Ducosyn Preparation	6	1	-	-

IV. STATUS OF APOLLO CHANGE ORDERS

ACO#	Date Rec'd	Cost Incr.	Auth Reqd.	Auth Rec'd	Current Status of ACO
3063	12/27/62	Yes	Yes	No	Released in advance of auth.
3064	12/18/62	No	No	-	Released 12/19/62
3065	"	Yes	Yes	No	Released in advance of auth.
3068	"	No	No	-	Released 12/19/63
3071	1/18/63	Yes	Yes	No	Released 1/21/63 in advance of auth.
3072	3/8/63	No	No	-	Released 3/12/63
3073	"	Yes	Yes	No	Released 3/12/63 in advance of auth.
3074	"	Yes	Yes	No	Released 3/14/63 in advance of auth.
3075	"	Yes	Yes	No	Released 3/12/63 in advance of auth.
3076	"	TBA	TBA	-	Released 3/12/63 in advance of auth.
3077	"	No*	No	-	Released 3/12/63
3078	"	Yes	Yes	No	Released 3/12/63 in advance of auth.
3079	"	Yes	Yes	No	Released 3/12/63 in advance of auth.
3080	"	No*	No	-	Released 3/12/63
3081	"	TBA	TBA	-	Released 3/15/63
3082	"	No	No	-	Released 3/12/63
3083	"	TBA	TBA	-	Released 3/15/63
3084	"	TBA	TBA	-	Released 3/15/63
3085	"	TBA	TBA	-	Released 3/15/63
3086	"	No	No	-	Released 3/12/63
3087	"	No	No	-	Released 3/12/63
3088	"	No	No	-	Released 3/12/63
3089	"	No	No	-	Released 3/12/63
3090	"	No	No	-	Released 3/12/63
3091	"	No	No	-	Released 3/12/63
3092	"	No	No	-	Released 3/15/63
3093	"	Yes	Yes	No	Released 3/22/63 in advance of auth.
3094	"	TBA	TBA	-	Released 3/15/63
3095	"	TBA	TBA	-	Released 3/15/63
3096	"	Yes	Yes	No	Released 3/15/63 in advance of auth.
3097	"	Yes	Yes	No	Released 3/15/63 in advance of auth.
3098	"	Yes	Yes	No	Released 3/15/63 in advance of auth.
3099	"	Yes	Yes	No	Released 3/22/63 in advance of auth.
3100	"	Yes	Yes	No	Released 3/12/63 in advance of auth.
3101	"	Yes	Yes	No	Released 3/12/63 in advance of auth.
3102	"	Yes	Yes	No	Released 3/12/63 in advance of auth.
3103	"	Yes	Yes	No	Released 3/12/63 in advance of auth.
3104	"	Yes	Yes	No	Released 3/12/63 in advance of auth.
3105	"	Yes	Yes	No	Released 3/12/63 in advance of auth.
3108	"	No	No	-	Released 3/12/63
3109	"	No	No	-	Released 3/12/63
3111	"	Yes	Yes	No	Released 3/14/63 in advance of auth.
3112	"	Decr.	Yes	No	Released in Feb. per TWX
3113	"	No	No	-	Released 3/12/63
3114	"	No	No	-	Released 3/12/63
3115	"	Yes	Yes	No	Released 3/15/63 in advance of auth.
3116	"	Yes	Yes	No	Released 3/15/63 in advance of auth.
3117	"	Yes	Yes	No	Released 3/15/63 in advance of auth.
3118	"	Yes	Yes	No	Released 3/15/63 in advance of auth.
3119	"	No**	No	-	Released 3/12/63
3120	"	No**	No	-	Released 3/12/63

* No cost if MIT/IL supplies Density Floats by 4/1/63.

** No cost if parts supplied by MIT/IL for Block I.

V. PROBLEM AREAS

A. There is an urgent need for the sepia master of new drawings P/N 96102, 96103, 96104, 96105, and 96106.

NOTE: Purchase of P/N 96106 Insulating Cover for Block II will be held up unless the adhesive backing is called out on the released master print.

B. There is also an urgent need for the following parts from MIT/IL in order to expedite incorporation of certain ACO's.

Qty.	P/N	Description
20	96014	Rotor
10	96015	Connector Wire Retainer
18	96106	End Cover, Insulating
18	96102	Identification Label, NASA
3 sets	MA96670-12	Density Floats (Block II)

NOTE: Please see attached Highlights of T.D. Meeting for clarification of these items.

Highlights of Apollo PIP T. D. Meeting

March 22, 1963

1. Reduction of Float Output Axis Angular Freedom from ± 5° to ± 1°:

   Sperry will make a rotor alignment fixture to provide ± 1/8° tolerance on alignment of rotors to stop pin. MIT/IL will do a tolerance study to determine tolerances required and fixtures necessary to accomplish the angular freedom reduction. Sperry indicated there was a possibility of a problem area in a null shift that is possible from the alignment fixture to the final test console due to variation in lead capacitance.

2. Change from Terniary Moding to Binary Moding:

   MIT/IL presented the reasons for this change. As a result, a Contracting Officer's Memo will be issued to "close loop" test S/N IAP-13 and possibly IAP-12 assuming the Test Spec is available by then. Sperry will investigate the possible use of the Polaris spare feed back electronics until MIT/IL can supply the Apollo feed back electronics.

3. Data Handling Board to Convert DC Signals into Pulses for the Counter:

   MIT/IL will supply to Sperry by April 4, 1963.

4. Apollo Acceptance Test Spec & Procedure:

   MIT/IL will issue an ACO to establish this document.

5. Sperry Designed Rotor Alignment Fixture per ACO #3115

   MIT/IL accepted the submitted design and authorized, per NASA Representative, the immediate build of the unit. The NASA rep. indicated a TWX would follow. This authorization was to include the build and the incorporation of ± 1° angular freedom. MIT/IL will issue an ACO for Block I covering the following points:

   a. Open up jewel I.D. to .002" clearance

   b. Open TIR of the Rotor to Pivot from .0003" to .00075". (Sperry will record in Data the direction and magnitude of the eccentricity.)

   c. Change RCR from .50/2.00 to .176/5.67

6. The Suspension Capacitor Module:

Four copies of the latest drawings were given to Sperry. These dwgs. contain reference to certain NASA Specs. which Sperry may not have on hand. Sperry will review the dwgs. and advise J. Miller of MIT/IL of the specs. not available. A NASA authorizing TWX is expected out Monday. On receipt, Sperry will release mfg. instructions.

7. Schedule:

Sperry outlined the various problems such as the unanticipated losses in grinding and late deliveries of piece parts from fabricating vendors, which are affected delivery schedules. It was generally agreed that schedules may slip one month at this time but would be made up before the end of the contract.

8. MIT/IL Supplied Parts:

a. Rotors - Twenty rotors were given to Sperry to cover scrappage in Block I

b. Connector Wire Retainer - New Dwg. to be issued by MIT/IL shortly but retainer will be available from MIT if Sperry cannot procure them in time.

c. NASA Identification Label - to be combined with the Module Label into 1 decal. New dwg. is to be issued by MIT/IL.

d. Density Floats for Block II - Three sets to be furnished by MIT/IL in time for Block II.

e. Mounting and Alignment Rings - Both parts still on hold for Block II. When new design is released, MIT/IL will supply initial quantities to maintain schedule.

9. G.F.E. Test Equipment:

MIT/IL recommends that Sperry review transfer of optical equipment from Polaris to Apollo. Sperry maintains that the Polaris equipment is required for the Test Procedure. MIT/IL claims that it hasn't been specified for the past year. This problem will be resolved at the next Sperry-MIT/IL meeting.

10. Shipping Containers:

NASA advised that they would be supplied for the June shipment to AC Spark Plug.

11. MIT/IL Test Results on IAP-9:

Test results were presented by MIT/IL. They then discussed the effects of the reset coil on performance and also discussed the effects of the reduction in angular freedom from $\pm 5^{\circ}$ to $\pm 1^{\circ}$ on performance.

12. Connector Harness for Block II with Module:

Sperry anti ipates problem since upon contacting Cannon on molding of #30 wires to Cannon Connector, Cannon advised they could only mold size #28 wires. If it is found necessary to go to #28 wire all around, then a space problem may exist in the unit. MIT/IL suggests possibility of using an intermediate splice to join the Cannon Connector #28 wires with the Alden Connector #30 wires. MIT/IL will investigate all of this prior to issuance of an ACO.

13. Apollo PIP Acceptance Test Specs:

Sperry indicated disagreement with three of the Preliminary Test Specs as follows:

a. S.G. Null Voltage - Sperry questions the need for the tight .1MV-RMS spec since operation will now be in the Binary Mode. MIT/IL agreed. Sperry suggested and MIT/IL agreed to .2MV-RMS.

b. Average Angular Spread - Specified as 2 arc seconds. Sperry's position is that at the time of the Apollo Contract signing, the yield was predicated on on 8 arc seconds which was derived from the existing Polaris spec. of 2 arc seconds with 4 times the pendulosity. MIT/IL stated that 2 arc seconds was now required for system performance requirements. Sperry indicated that this new requirement will have a drastic effect on yield.

c. Null Alignment - Specified as 1/3 milli-radian. Sperry objected to this test altogether since only 1 unit is known to have met it and since elastic restraint is essentially constant to ± 10 MR. Sperry feels that ± 5 M.R. spec is more realistic and believes that if the unit meets bias acceleration requirements, it should not be rejected regardless of misalignment. In addition, there is a null shift exceeding 1/3 M.R. which arises from the alignment stand to the final test stand due to changes in lead capacity.

NOTE: MIT/IL will hold a meeting Monday to review and resolve items #13-b and 13-c above.

APOLLO 16 PIP MODEL D PROGRAM (R&D)

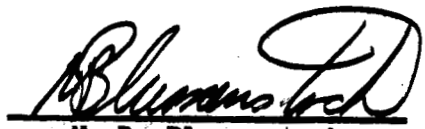
Contract NAS 9-455

Weekly Progress Report No. 48

April 1, 1963

Prepared by

SPERRY GYROSCOPE COMPANY
Division of Sperry Rand Corporation
Great Neck, New York



N. R. Blumenstock
Engineering Program Director

I. INTRODUCTION

This report summarizes the Sperry activities and progress achieved under Contract NAS 9-455 during the period March 25, 1963 through March 31, 1963.

II. GENERAL ACTIVITIES

A. Unitw #IAP-12 and IAP-13 are now in Ducosyn Assembly.

B. John Morgan contacted E. Fairweather by telephone 3/25/63 re one of the new drawings not yet on hand:

P/N96106 Insulator Cover - Sperry could not order since the advance copy of the dwg. shows adhesive spec. as "later". MIT/IL advised procurement without adhesive. The dwg. will be revised to show this and the installment instructions will be revised to reflect a cementing procedure.

C. Twenty P/N IAP96014 Rotors were received from MIT/IL to cover Block I scrappage. One of these arrrived in a chipped condition.

D. TWX #TT623541 authorizing go-ahead on ACO's 3097 and 3115, was received on 3/25/63 from the NASA Contracting Officer: M. Holzman. These ACO's are the Suspension Capacitor Module installation and the Sperry designed Rotor Alignment Fixture. Both jobs were released for manufacture.

E. TWX #TT623570, dated 3/27/63, from E. Fairweather of MIT/IL covered the following points:

1. Authorized use of single polythermalzee wire in place of heavy polythermaleze wire ASAP in all Model D PIP units SG and TG Microsyns. Change orders were to follow. (This is already underway.)

2. Ferrite rotor material was changed from MN-31 to MN-31-M. (This affects only future orders since Mod D PIP rotors have already been procurred.)

3. Authorized use of glass tubing in place of TYGON tubing for introduction of Damping Fluid into the Fill Tank. (Sperry is investigating this change and will submit estimate of cost ASAP.)

III. STATUS OF MAJOR PARTS AND SUB-ASSEMBLIES

A. Status of Assembly

Unit No.	Remarks
AP-1	Delivered
AP-2	"
AP-3	"
AP-4	"
AP-5	"
AP-6	"
AP-7	Converted to IAP-9
AP-8	Converted to IAP-10
AP-9	Delivered
IAP-10	"
IAP-11	"
IAP-12	In ducosyn assembly
IAP-13	In ducosyn assembly

B. Torque and Signal Generator Microsyn Assemblies - Block "I"

	S.G. #IAP96059		T.G. #IAP96126	
	Total Completed (to date)	Additional Parts in Process	Total Completed (to date)	Additional Parts in Process
Stacked & Bonded IAP96016	28	-	24	-
Surface Grind	28	-	24	-
Mount Coils & Terminal Rings	28	-	24	-
Impregnation	28	-	24	-
Assembled into Housing	21	-	24	-
Potted, Cured & Cycled	21	-	23	-
Ground Assemblies	13	6	8	14
Inspection	13	-	8	-
Ducosyn Preparation	5	8	5	3
	S.G. Coil (IAP96127)		T.G. Coil (IAP96131)	
Inspection	25	-	25	-
Tested & Grouped	25	-	25	-

C. Torque and Signal Generator Microsyn Assemblies - Block "II"

	S.G. #IIAP108013		T.G. #IIAP108031	
Stacked & Bonded	59	-	-	-
Surface Grind	59	-	-	-
Mount Coils & Terminal Rings	-	-	-	-
Impregnation	-	-	-	-
Assembled into Housing	-	-	-	-
Potted, Cured & Cycled	-	-	-	-
Ground Assemblies	-	-	-	-
Inspection	-	-	-	-
Ducosyn Preparation	-	-	-	-
	S.G. Coil (#IIAP108016)		T.G. Coil (#IIAP108033)	
Inspection	-	-	-	-
Tested & Grouped	-	-	-	-

D. Internal Suspension	Block "I" (IAP93236)		Block "II" (IIAP108021)	
Stacked, Bonded & Ground	50	-	-	-
Inspection	50	-	-	-
Durafilm	50	-	-	-
Coil Winding & Terminal Assembly	50	-	-	-
Final Test of I.S. Assembly	42	-	-	-
Impregnation	42	-	-	-
Assembled into Housing	42	-	-	-
Potted, Cured & Cycled	38	-	-	-
Grinding	23	10	-	-
Inspection	17	5	-	-
Ducosyn Preparation	10	7	-	-

IV. STATUS OF APOLLO CHANGE ORDERS

ACO#	Date Rec'd	Cost Incr.	Auth Reqd.	Auth Rec'd	Current Status of ACO
3063	12/27/62	Yes	Yes	No	Released in advance of auth.
3064	12/18/62	No	No	-	Released 12/19/62
3065	"	Yes	Yes	No	Released in advance of auth.
3068	"	No	No	-	Released 12/19/63
3071	1/18/63	Yes	Yes	No	Released 1/21/63 in advance of auth.
3072	3/8/63	No	No	-	Released 3/12/63
3073	"	Yes	Yes	No	Released 3/12/63 in advance of auth.
3074	"	Yes	Yes	No	Released 3/14/63 in advance of auth.
3075	"	Yes	Yes	No	Released 3/12/63 in advance of auth.
3076	"	TBA	TBA	-	Released 3/12/63 in advance of auth.
3077	"	No*	No	-	Released 3/12/63
3078	"	Yes	Yes	No	Released 3/12/63 in advance of auth.
3079	"	Yes	Yes	No	Released 3/12/63 in advance of auth.
3080	"	No*	No	-	Released 3/12/63
3081	"	TBA	TBA	-	Released 3/15/63
3082	"	No	No	-	Released 3/12/63
3083	"	TBA	TBA	-	Released 3/15/63
3084	"	TBA	TBA	-	Released 3/15/63
3085	"	TBA	TBA	-	Released 3/15/63
3086	"	No	No	-	Released 3/12/63
3087	"	No	No	-	Released 3/12/63
3088	"	No	No	-	Released 3/12/63
3089	"	No	No	-	Released 3/12/63
3090	"	No	No	-	Released 3/12/63
3091	"	No	No	-	Released 3/12/63
3092	"	No	No	-	Released 3/15/63
3093	"	Yes	Yes	No	Released 3/22/63 in advance of auth.
3094	"	TBA	TBA	-	Released 3/15/63
3095	"	TBA	TBA	-	Released 3/15/63
3096	"	Yes	Yes	No	Released 3/15/63 in advance of auth.
3097	"	Yes	Yes	No	Released 3/15/63 in advance of auth.
3098	"	Yes	Yes	No	Released 3/15/63 in advance of auth.
3099	"	Yes	Yes	No	Released 3/12/63 in advance of auth.
3100	"	Yes	Yes	No	Released 3/12/63 in advance of auth.
3101	"	Yes	Yes	No	Released 3/12/63 in advance of auth.
3102	"	Yes	Yes	No	Released 3/12/63 in advance of auth.
3103	"	Yes	Yes	No	Released 3/12/63 in advance of auth.
3104	"	Yes	Yes	No	Released 3/12/63 in advance of auth.
3105	"	Yes	Yes	No	Released 3/12/63 in advance of auth.
3108	"	No	No	-	Released 3/12/63
3109	"	No	No	-	Released 3/12/63
3111	"	Yes	Yes	No	Released 3/14/63 in advance of auth.
3112	"	Decr.	Yes	No	Released in Feb. per TWX
3113	"	No	No	-	Released 3/12/63
3114	"	No	No	-	Released 3/12/63
3115	"	Yes	Yes	No	Released 3/15/63 in advance of auth.
3116	"	Yes	Yes	No	Released 3/15/63 in advance of auth.
3117	"	Yes	Yes	No	Released 3/15/63 in advance of auth.
3118	"	Yes	Yes	No	Released 3/15/63 in advance of auth.
3119	"	No**	No	-	Released 3/12/63
3120	"	No**	No	-	Released 3/12/63

* No cost if MIT/IL supplies Density Floats by 4/1/63.

** No cost if parts supplied by MIT/IL for Block I.

D. The requirement for final information on the Suspension Capacitor Assembly will be affected by the apparent 4-5 week schedule slippage resulting from grinding and other problems. Although the due dates for specific items such as the NASA specs #1002057, 1005400 and 1005404 could slip with the schedule, it would be helpful to have all required information earlier.

NOTE: All of the Suspension Capacitor Assembly prints received from MIT/IL contain the statement: "Not approved for Production". Since Sperry had to release the job with these prints, this statement was written out prior to release.

V. PROBLEM AREAS

A. Sperry is awaiting: - Issuance of sepia masters for new drawings P/N 96102, 96103, 96104, 96105, and 96106

- Issuance of a Block II ACO establishing the desired Connector Harness configuration for Block II

- Issuance of Block II Mounting and Alignment ring new design via ACO

B. There is also an urgent need for the following parts from MIT/IL in order to expedite incorporation of certain ACO's.

Qty.	P/N	Description
10	96105	Connector Wire Retainer
18	96106	End Cover, Insulating
18	96102 (revised)	Identification Label, NASA
3 sets	MA96670-12	Density Floats (Block II)

C. A Potential Problem Area:

Due to the apparent concern on the part of the Apollo system people with possible variation in damping coef.,Sperry has begun a critical evaluation of all procedures concerned with the damping fluid and the processing proceduresused during degassing and filling operations.

An examination of the principle of operation of the specified Molecular Vacuum gage shows that the indicated pressure of this gage is proportional to the molecular weight of the fluid whose pressure is being measured. Since this gage is calibrated for dry air (molecular wt. 28) and is being used with hydrocarbon vapors (molecular wt 1000) an appreciable error in pressure exists between absolute pressure and the indicated gage pressure. The literature furnished by the manufacturer indicates that the full scale value of pressure of this molecular gage when used with a fluid of molecular weight of 1000 is approximately 0.1 mm. The procedure presently calls for filling at 20 mm which is the full scale value for this gage when used with dry air. A further problem could exist during degassing. If this gage is used uncalibrated for the damping fluid molecular weight, and the indicated pressure is used during degassing (specified in Addendum D-1 to be 50 microns) an absolute air pressure considerably lower than this will actually be attained. If this done the higher vapor pressure fraction of the damping fluid will be"stripped out"resulting in a change in viscosity (in the instrument a change in damping coef.) and density.

Sperry's presently investigating the magnitude of this possibility.

Sperry feels that a TD meeting to discuss this potential problem and to take steps deemed necessary to minimize its effects should be initiated in the near future.